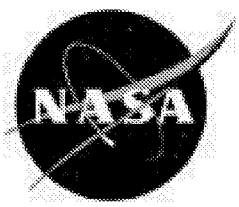
NASA/SP—2000–7037/SUPPL420
October 2000

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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01 Aeronautics (General) 1

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02 Aerodynamics 2

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery.

03 Air Transportation and Safety 9

Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*.

04 Aircraft Communications and Navigation 12

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control.

05 Aircraft Design, Testing and Performance 16

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology.

07 Aircraft Propulsion and Power 22

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

08 Aircraft Stability and Control 24

Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots. For related information, see also *05 Aircraft Design, Testing and Performance* and *06 Avionics and Aircraft Instrumentation*.

09 Research and Support Facilities (Air) 25

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Typical Report Citation and Abstract

❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10' to 50', and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65' swept forebody serrations tended to roll together, while vortices from 40' swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 420)

OCTOBER 2000

01
AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft.

20000098590 NASA Langley Research Center, Hampton, VA USA
Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 419
September 2000; 88p; In English
Report No.(s): NASA/SP-2000-7037/SUPPL419; NAS 1.21:7037/SUPPL419; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This supplemental issue of Aeronautical Engineering, A Continuing Bibliography with Indexes (NASA/SP-2000-7037) lists reports, articles, and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. Two indexes-subject and author are included after the abstract section.
CASI
Aeronautical Engineering; Bibliographies; Indexes (Documentation); Aerodynamics

20000101025 Johns Hopkins Univ., Baltimore, MD USA
Entrepreneurial Success and Failure in the Aviation Industry: The History of the Waco Aircraft Company, 1919-1963
Jones, Howard G., III, Johns Hopkins Univ., USA; Nov. 03, 1999; 355p; In English
Report No.(s): AD-A371337; FY99-395; Copyright; Avail: Issuing Activity

This dissertation shows how the history of the Waco Aircraft Company reflects the transformation of the American economy in the twentieth century. Beginning just after the First World War, its entrepreneur, Clayton J. Brukner, developed a network of relationships within the aviation industry. This allowed his company to develop significant competitive advantages in the private flying market. Those advantages and the popular appeal of aviation helped Waco to become the largest manufacturer of civilian aircraft by 1929. The transformation of business-government relations during the New Deal demanded changes in Brukner's business strategy. The depression significantly cut sales of its popular biplanes, but Waco kept its Troy, Ohio, factory open and earned some profits during the downturn. Brukner's involvement with the trade associations in the 1930s revealed the critical role the government, the military in particular, played in the development of aviation. His flawed leadership in the changing context led to decisions that degraded the quality of its network signals and diminished Waco's effectiveness in crafting appropriate policies. As the international situation grew increasingly tense throughout the 1930s, Waco, like other manufacturers turned to exports to enhance sales. Contracts with foreign governments partially offset the setback the depression had caused domestically. They did not, however, drive Brukner to evaluate sufficiently Waco's potential participation in the U.S. military market. Only after the Munich Crisis in September 1938, when President Franklin D. Roosevelt decided to call for increased military spending, did the Waco Aircraft Company position itself to receive defense contracts. It was almost three years, however, before the Army Air Forces directed the company to design and manufacture transport aircraft and cargo gliders. In the meantime Brukner had not developed the organizational capabilities needed to manage military contracts. Simultaneously directing the design, engineering changes, and production of numerous different models of military gliders proved extremely challenging for Waco. The effort exhausted the company leadership, and Waco emerged from the war with few resources to invest in its reconversion to civilian production. Waco produced no more aircraft, making it one of the notable casualties of the war.
DTIC
Aircraft Industry; Civil Aviation; Economy; Industrial Management

02
AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery.

20000094540 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Computational Fluid Dynamics Testing for Drag Reduction of an Aircraft Laser Turret
Schwabacher, Gregory J.; Mar. 2000; 114p; In English
Report No.(s): AD-A380295; AFIT/GAE/ENY/00M-11; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A computational study was conducted on the use of aft-mounted fairings for passive drag reduction on a sphere at Re = 866,000. The sphere dimensions and operating Reynolds number were selected to approximate the flow around a proposed aircraft laser turret for which experimental data was available. To establish the validity of the computational model, flow predictions were compared to sphere data available in the open literature. The model, exercised in both the laminar and turbulent modes, showed good agreement with the published data. Two proposed laser turret fairings were then evaluated computationally: a large fairing (beginning at 49.5 degrees past the sphere apex) and a small fairing (beginning at 58.95 degrees past the sphere apex). Existing wind tunnel models were used to generate axisymmetric computational grids that approximated the geometry of these models. The computed flow field and associated drag reduction were comparable to the experimental results obtained from the wind tunnel testing. Differences in drag from the model to the experiment were explained by the axisymmetric simplifications made in the model. Finally, a new, optimized fairing model was designed which eliminated the separation zone on the aft portion of the sphere. The optimized model predicted double the drag reduction compared to the large fairing computational model.
DTIC
Computational Fluid Dynamics; Drag Reduction; Laser Weapons; Fairings; Turbulent Flow; Laminar Flow; Afterbodies; Separated Flow

20000094542 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA
Dynamics of Aerospace Vehicles -- Nonlinear Flight Mechanics *Final Report, 1 Jun. 1987-30 Jun. 1998*
Jenkins, Jerry E.; Addington, Gregory A.; Beran, Phillip S.; Grismer, Deborah S.; Hanff, Ernest S.; May 2000; 54p; In English
Contract(s)/Grant(s): Proj-2307
Report No.(s): AD-A380300; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The unsteady aerodynamics due to vortex breakdown are studied, with application to a 65-degree delta wing. At high angles of attack, the flow field response to changes in attitude contains multiple time scales. Furthermore, severe nonlinearities are present which further complicate aerodynamic modeling. The implications for wind tunnel testing and aerodynamic modeling are discussed.
DTIC
Aerospace Vehicles; Vortex Breakdown; Wind Tunnel Tests; Unsteady Aerodynamics; Delta Wings

20000094556 NASA Dryden Flight Research Center, Edwards, CA USA
Flow-Field Survey in the Test Region of the SR-71 Aircraft Test Bed Configuration
Mizukami, Masashi, NASA Dryden Flight Research Center, USA; Jones, Daniel, NASA Dryden Flight Research Center, USA; Weinstock, Vladimir D., Analytical Services and Materials, Inc., USA; August 2000; 120p; In English
Contract(s)/Grant(s): RTOP 523-90-24
Report No.(s): NASA/TM-2000-209025; H-2414; NAS 1.15:209025; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A flat plate and faired pod have been mounted on a NASA SR-71A aircraft for use as a supersonic flight experiment test bed. A test article can be placed on the flat plate; the pod can contain supporting systems. A series of test flights has been conducted to validate this test bed configuration. Flight speeds to a maximum of Mach 3.0 have been attained. Steady-state sideslip maneuvers to a maximum of 2 deg have been conducted, and the flow field in the test region has been surveyed. Two total-pressure rakes, each with two flow-angle probes, have been placed in the expected vicinity of an experiment. Static-pressure measurements have been made on the flat plate. At subsonic and low supersonic speeds with no sideslip, the flow in the surveyed region is quite uniform. During sideslip maneuvers, localized flow distortions impinge on the test region. Aircraft sideslip does not produce a uniform sidewash over the test region. At speeds faster than Mach 1.5, variable-pressure distortions were observed in the test

region. Boundary-layer thickness on the flat plate at the rake was less than 2.1 in. For future experiments, a more focused and detailed flow-field survey than this one would be desirable.
Author
Flow Distribution; Surveys; Data Acquisition; SR-71 Aircraft; Aircraft Configurations; Flight Tests; Flow Distortion; Supersonic Inlets; Fluid Flow

20000094565 Army Aviation Systems Command, Army Aeroflightdynamics Directorate, Moffett Field, CA USA
Application of Three-Component PIV to a Hovering Rotor Wake
Yamauchi, Gloria K., NASA Ames Research Center, USA; Lourenco, Luiz, Florida State Univ., USA; Heineck, James T., NASA Ames Research Center, USA; Wadcock, Alan J., Aerospace Computing, Inc., USA; Abrego, Anita I., NASA Ames Research Center, USA; [2000]; 6p; In English; 56th; 56th Aerodynamics Session: AHS Forum, 2-4 May 2000, Virginia Beach, VA, USA; Sponsored by American Helicopter Society, Inc., USA
Contract(s)/Grant(s): RTOP 576-03-14; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The key to accurate predictions of rotorcraft aerodynamics, acoustics, and dynamics lies in the accurate representation of the rotor wake. The vortical wake computed by rotorcraft CFD analyses typically suffer from numerical dissipation before the first blade passage. With some a priori knowledge of the wake trajectory, grid points can be concentrated along the trajectory to minimize the dissipation. Comprehensive rotorcraft analyses based on lifting-line theory rely on classical vortex models and/or semi-empirical information about the tip vortex structure. Until the location, size, and strength of the trailed tip vortex can be measured over a range of wake ages, the analyses will continue to be adjusted on a trial and error basis in order to correctly predict blade airloads, acoustics, dynamics, and performance. Using the laser light sheet technique, tip vortex location can be acquired in a straightforward manner. Measuring wake velocities and vortex core size, however, has been difficult and tedious using point-measurement techniques such as laser velocimetry. Recently, the Particle Image Velocimetry (PIV) technique has proven to be an efficient method for acquiring velocity measurements over relatively large areas and volumes of a rotor wake. The work reported to date, however, has been restricted to 2-component velocity measurements of the rotor wake. Three-component velocity measurements of a hovering rotor wake were acquired at NASA Ames Research Center in May 1999. This experiment represents a major step toward understanding the detailed structure of a rotor wake. This paper will focus primarily on the experimental technique used in acquiring this data. The accuracy and limitations of the current technique will also be discussed. Representative velocity field measurements will be included.
Author
Rotary Wing Aircraft; Acoustics; Wakes; Vortices; Velocity Measurement; Rotor Aerodynamics; Errors; Computational Grids

20000095491 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Struktur Roket dan Satelit, Jakarta, Indonesia
Investigation of the Aerodynamic Coefficients of RKX 180 mm Guided Rockets ***Penelitian Koefisien Aerodinamik Roket Kendali RKK-180 mm***
Ginting, Salam, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Sumartinah, Endang, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; January 2000; ISSN 0126-0480; Volume 2, No. 1, pp. 17-26; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The aerodynamic coefficients research of RKX-180 mm rocket is done such as input to aerodynamics pressure during burning time attitude rocket prediction. The configuration rocket is designed for sharp maneuver, so that, by placing the wing rocket at central gravity region, the static margin magnitude is expediented as small as possible. The evaluation distance between aerodynamics pressure and central gravity at 1.5 to 3.5 Mach number speeds during thrust on needs done for that. The Analytic theory Aerodynamics calculation is expandable by quadrature Multhopp is used to solution this problems. For knowing static margin magnitude during turning speed, the change rocket attitude is needed, so that static stability rocket is shown more earlier. Beside that, such as input to software and hardware guidance design system of the RKX-180 mm rocket, the static margin is needed. The result shows that static margin value to incline to increase by increasing Mach number value. So, because the highest value of static margin at around 3.5 Mach number speed, then that is taken as the input data to hardware and software guidance design system.
Author
Aerodynamic Coefficients; Maneuverability; Guidance (Motion); Rocket Engines; Performance Prediction

20000095584 Massachusetts Inst. of Tech., Dept. of Mechanical Engineering, Cambridge, MA USA
A Comparison of Experimental and Computational Analyses of Two Dimensional Foil Sections
Fairman, Randall S.; Jun. 2000; 71p; In English
Contract(s)/Grant(s): N62271-97-G-0026

Report No.(s): AD-A379625; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Performance of two dimensional foil sections with traditional, blunt and cupped trailing edge geometries are experimentally and computationally evaluated. Traditional foils show less than 1% error in lift slope and less than 0.1 degree error in predicted angle of attack. Foils which include trailing edge separation due to a trailing edge cup show up to 30% error in lift slope and 1.0 degree error in predicted angle of attack. Foils which include trailing edge separation due to bluntness show good correlation in lift slop (2% error) but still show up to 0.9 degree error in predicted angle of attack. Experimental and numerical evaluations are conducted in order to assess whether the differences are caused by the experimental or computational fluid dynamics. All known experimental uncertainties are exhausted without explaining the differences between predicted and measured lift.

DTIC

Airfoils; Blunt Trailing Edges; Hydrodynamics; Computational Fluid Dynamics; Two Dimensional Flow; Boundary Layer Flow

20000096264 Arizona Univ., Dept. of Aerospace and Mechanical Engineering, Tucson, AZ USA

Investigative Research on the Effect of Zero-Mass Jets on the Base Drag of Axisymmetric Bodies at Supersonic Speeds

Final Report, 21 Sep. 1998 - 20 Mar. 1999

Fasel, Hermann F.; Apr. 2000; 31p; In English

Contract(s)/Grant(s): DAAG55-98-1-496

Report No.(s): AD-A379070; ARO-39166.1-EG-II; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Preliminary investigations of wakes behind bodies with a blunt base have been carried out. For low subsonic Mach numbers, we have found that zero-mass jets that are generated by high-frequency forcing can have a significant effect on the flow structures that develop downstream of the base. These investigations were carried out using Direct Numerical Simulations (DNS) based on the complete Navier-Stokes equations for compressible flows. The codes for these simulations were developed with previous funding from ARO and have been tested extensively and validated by numerous comparison calculations. In the simulations, the zero-mass jets were generated by high-frequency, periodic blowing and suction at the base. With funds from the present STIR grant, we wanted to confirm, validate, and extend our preliminary investigations on the effects of zero-mass jets on the wake structures behind an axisymmetric body with a blunt base. Of particular interest was the question if the numerical simulations of zero-mass jets could be extended to high subsonic and supersonic Mach numbers. Toward this end, our Navier-Stokes code, which was previously developed for investigating supersonic base flows, was modified to allow for the introduction of high-frequency disturbances at the base of the body.

DTIC

Computational Fluid Dynamics; Aerodynamic Drag; Supersonic Flow; Mass Flow; Compressible Flow; Two Dimensional Flow; Subsonic Flow; Navier-Stokes Equation; Jet Flow; Axisymmetric Bodies

20000097390 NASA Langley Research Center, Hampton, VA USA

First-Order Model Management With Variable-Fidelity Physics Applied to Multi-Element Airfoil Optimization

Alexandrov, N. M., NASA Langley Research Center, USA; Nielsen, E. J., NASA Langley Research Center, USA; Lewis, R. M., NASA Langley Research Center, USA; Anderson, W. K., NASA Langley Research Center, USA; [2000]; 12p; In English; 8th; Multidisciplinary Analysis and Optimization, 6-8 Sep. 2000, Long Beach, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS1-97046

Report No.(s): AIAA Paper 2000-4886; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

First-order approximation and model management is a methodology for a systematic use of variable-fidelity models or approximations in optimization. The intent of model management is to attain convergence to high-fidelity solutions with minimal expense in high-fidelity computations. The savings in terms of computationally intensive evaluations depends on the ability of the available lower-fidelity model or a suite of models to predict the improvement trends for the high-fidelity problem, Variable-fidelity models can be represented by data-fitting approximations, variable-resolution models. variable-convergence models. or variable physical fidelity models. The present work considers the use of variable-fidelity physics models. We demonstrate the performance of model management on an aerodynamic optimization of a multi-element airfoil designed to operate in the transonic regime. Reynolds-averaged Navier-Stokes equations represent the high-fidelity model, while the Euler equations represent the low-fidelity model. An unstructured mesh-based analysis code FUN2D evaluates functions and sensitivity derivatives for both models. Model management for the present demonstration problem yields fivefold savings in terms of high-fidelity evaluations compared to optimization done with high-fidelity computations alone.

Author

Airfoils; Optimization; Approximation; Nonlinear Programming; Models; Unstructured Grids (Mathematics)

20000097392 NASA Langley Research Center, Hampton, VA USA
Identification and Minimization of Errors in Doppler Global Velocimetry Measurements
Meyers, James F., NASA Langley Research Center, USA; Lee, Joseph W., NASA Langley Research Center, USA; [2000]; 13p; In English; 10th; Applications of Laser Techniques to Fluid Mechanics, 10-13 Jul. 2000, Lisbon, Portugal; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A systematic laboratory investigation was conducted to identify potential measurement error sources in Doppler Global Velocimetry technology. Once identified, methods were developed to eliminate or at least minimize the effects of these errors. The areas considered included the Iodine vapor cell, optical alignment, scattered light characteristics, noise sources, and the laser. Upon completion the demonstrated measurement uncertainty was reduced to 0.5 m/sec.
Author
Identifying; Miniaturization; Error Analysis; Velocity Measurement

20000099714 NASA Langley Research Center, Hampton, VA USA
Aerothermodynamic Analysis of Stardust Sample Return Capsule with Coupled Radiation and Ablation
Gupta, Roop N., NASA Langley Research Center, USA; Journal of Spacecraft and Rockets; July - August 2000; Volume 37, No. 4, pp. 507-514; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-0227; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

An aerothermodynamic analysis of the forebody aeroshell of the Stardust Sample Return Capsule is carried out by using the axisymmetric viscous shock-layer equations with and without fully coupled radiation and ablation. Formulation of the viscous shock-layer equations with shoulder radius as the length scale and implementation of the Vigneron pressure condition allow resolution of the flowfield over the shoulder. With a predominantly supersonic outflow over the shoulder, a globally iterated solution or viscous shock-layer equations can be obtained. The stagnation-point results are obtained along a specified trajectory, whereas detailed calculations along the body are provided at the peak-heating point. The equilibrium calculations with ablation injection are the focus of the present study because of the lack of a general chemical nonequilibrium analysis that accounts for both surface and flowfield effect. The equilibrium calculations also provide a simple way to conserve surface (and flowfield) elemental composition for the current small ablation injection rates, where the surface elemental composition is a mixture of freestream and ablator elements. Therefore, the coupled laminar and turbulent flow solutions with radiation and ablation are obtained by using the equilibrium flow chemistry, whereas a nonequilibrium chemistry model is used for solutions without ablation and turbulence. Various computed results are compared with those obtained by the other researchers.
Author
Ablation; Aerothermodynamics; Stardust Mission; NASA Space Programs; Forebodies; Aeroshells; Radiation Transport

20000099722 NASA Langley Research Center, Hampton, VA USA
Hyper-X Storage Separation Wind Tunnel Test Program
Woods, William C., NASA Langley Research Center, USA; Holland, Scott D., NASA Langley Research Center, USA; Difulvio, Michael, NASA Langley Research Center, USA; [2000]; 18p; In English; 18th; Applied Aerodynamics, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-4008; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA's Hyper-X research program was developed primarily to flight demonstrate a supersonic combustion ramjet engine, fully integrated with a forebody designed to tailor inlet flow, conditions and a free expansion nozzle/afterbody to produce positive thrust at design flight conditions. With a point-designed propulsion system, the vehicle must depend upon some other means for boost to its design flight condition. Clean separation from this initial propulsion system stage within less than a second is critical to the success of the flight. This paper discusses the early planning activity, background, and chronology that developed the series of wind tunnel tests to support multi degree of freedom simulation of the separation process. Representative results from each series of tests are presented and issues and concerns during the process and current status will be highlighted.
Derived from text
Wind Tunnel Tests; Supersonic Combustion Ramjet Engines; Simulation; Inlet Flow

20000099746 NASA Langley Research Center, Hampton, VA USA
Multidisciplinary Aerodynamic-Structural Shape Optimization Using Deformation (MASSOUD)
Samareh, Jamshid A., NASA Langley Research Center, USA; [2000]; 12p; In English; 8th; Multidisciplinary Analysis and Optimization, 6-8 Sep. 2000, Long Beach, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a multidisciplinary shape parameterization approach. The approach consists of two basic concepts: (1) parameterizing the shape perturbations rather than the geometry itself and (2) performing the shape deformation by means of the soft object animation algorithms used in computer graphics. Because the formulation presented in this paper is independent of grid topology, we can treat computational fluid dynamics and finite element grids in a similar manner. The proposed approach is simple, compact, and efficient. Also, the analytical sensitivity derivatives are easily computed for use in a gradient-based optimization. This algorithm is suitable for low-fidelity (e.g., linear aerodynamics and equivalent laminated plate structures) and high-fidelity (e.g., nonlinear computational fluid dynamics and detailed finite element modeling analysis tools. This paper contains the implementation details of parameterizing for planform, twist, dihedral, thickness, camber, and free-form surface. Results are presented for a multidisciplinary design optimization application consisting of nonlinear computational fluid dynamics, detailed computational structural mechanics, and a simple performance module.
Author
Aerodynamic Configurations; Deformation; Multidisciplinary Design Optimization; Parameterization; Shapes; Computational Fluid Dynamics; Structural Analysis

20000099747 NASA Langley Research Center, Hampton, VA USA
Langley Wind Tunnel Data Quality Assurance-Check Standard Results
Hemsch, Michael J., NASA Langley Research Center, USA; Grubb, John P., Lockheed Martin Corp., USA; Krieger, William B., Lockheed Martin Corp., USA; Cler, Daniel L., NASA Langley Research Center, USA; [2000]; 23p; In English; 21st; Advanced Measurement Technology and Ground Testing, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS1-96014
Report No.(s): AIAA Paper 2000-2201; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A framework for statistical evaluation, control and improvement of wind funnel measurement processes is presented The methodology is adapted from elements of the Measurement Assurance Plans developed by the National Bureau of Standards (now the National Institute of Standards and Technology) for standards and calibration laboratories. The present methodology is based on the notions of statistical quality control (SQC) together with check standard testing and a small number of customer repeat-run sets. The results of check standard and customer repeat-run -sets are analyzed using the statistical control chart-methods of Walter A. Shewhart long familiar to the SQC community. Control chart results are presented for. various measurement processes in five facilities at Langley Research Center. The processes include test section calibration, force and moment measurements with a balance, and instrument calibration.
Author
Statistical Analysis; Wind Tunnel Tests; Calibrating; Wind Measurement

20000099748 NASA Langley Research Center, Hampton, VA USA
Hyper-X Research Vehicle (HXRV) Experimental Aerodynamics Test Program Overview
Holland, Scott D., NASA Langley Research Center, USA; Woods, William C., NASA Langley Research Center, USA; Engelund, Walter C., NASA Langley Research Center, USA; [2000]; 14p; In English; 18th; Applied Aeronautics, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-4011; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper provides an overview of the experimental aerodynamics test program to ensure mission success for the autonomous flight of the Hyper-X Research Vehicle (HXRV). The HXRV is a 12-ft long, 2700 lb lifting body technology demonstrator designed to flight demonstrate for the first time a fully airframe integrated scramjet propulsion system. Three flights are currently planned, two at Mach 7 and one at Mach 10, beginning in the fall of 2000. The research vehicles will be boosted to the prescribed scramjet engine test point where they will separate from the booster, stabilize, and initiate engine test. Following 5+ seconds of powered flight and 15 seconds of cow-open tares, the cowl will close and the vehicle will fly a controlled deceleration trajectory which includes numerous control doublets for in-flight aerodynamic parameter identification. This paper reviews the preflight testing activities, wind tunnel models, test rationale, risk reduction activities, and sample results from wind tunnel tests supporting the flight trajectory of the HXRV from hypersonic engine test point through subsonic flight termination.
Author
Aerodynamics; Research Vehicles; Performance Tests; Autonomy; Engine Tests; Hypersonic Speed; Parameter Identification; Supersonic Combustion Ramjet Engines; Wind Tunnel Tests; Experiment Design

20000101008 Helsinki Univ. of Technology, Lab. of Theoretical and Applied Mechanics, Espoo, Finland

State-of-the-Art Review of Rotordynamics

Puckett, Anthony D., Helsinki Univ. of Technology, Finland; vonHertzen, Raimo, Helsinki Univ. of Technology, Finland; 1999; ISSN 1456-6311; 24p; In English

Report No.(s): PB2000-102654; ISBN 951-22-4656-2; Copyright; Avail: National Technical Information Service (NTIS)

This document is a state-of-the-art review of rotordynamics conducted by the Laboratory of Theoretical and Applied Mechanics at Helsinki University of Technology (HUT). It presents the most current journal articles that could be found on the subject of rotordynamics and specifically vibrations of rotors with imperfections such as asymmetry, initial bending, imbalance, etc. This document also includes information on currently available rotordynamic software.

NTIS

Rotor Dynamics; Abstracts

20000101059 NASA Langley Research Center, Hampton, VA USA

DSMC Simulation of Separated Flows About Flared Bodies at Hypersonic Conditions

Moss, James N., NASA Langley Research Center, USA; [2000]; 20p; In English; European Congress on Computational Methods in Applied Sciences and Engineering, 11-14 Sep. 2000, Barcelona, Spain; Original contains color illustrations; Copyright; Avail: Issuing Activity

This paper describes the resulting of a numerical study of interacting hypersonic flows at conditions produced in ground-based test facilities. The computations are made with the direct simulation Monte Carlo (DSMC) method of Bird. The focus is on Mach 10 flows about flared axisymmetric configurations, both hollow cylinder flares an double cones. The flow conditions are those for which experiments have or will be performed in the ONERA R5Ch low-density wind tunnel and the Calspan-University of Buffalo Research Center (CUBRC) Large Energy National Shock (LENS) tunnel. The range of flow conditions, model configurations, and model sizes provides a significant range of shock/shock and shock/boundary layer interactions at low Reynolds number conditions. Results presented will highlight the sensitivity of the calculations to grid resolution, contrast the differences in flow structure for hypersonic cold flows and those of more energetic but still low enthalpy flows, and compare the present results with experimental measurements for surface heating, pressure, and extent of separation. Author

Monte Carlo Method; Numerical Analysis; Hypersonic Flow; Shock Wave Interaction; Computerized Simulation

20000101617 Risoe National Lab., Wind Energy and Atmospheric Physics Dept., Roskilde, Denmark

Airfoil characteristics for wind turbines

Bak, C.; Fuglsang, P.; Soerensen, N. N.; Aagaard Madsen, H.; Wen, Zhong Shen; Mar. 31, 1999; 54p; In English

Report No.(s): DE99-754413; RISO-R-1065(EN); ISBN 87-550-2415-7; No Copyright; Avail: Department of Energy Information Bridge

Airfoil characteristics for use in the Blade Element Momentum (BEM) method calculating the forces on Horizontal Axis Wind Turbines (HAWT) are derived by use of systematic methods. The investigation and derivation of the airfoil characteristics are based on four different methods: 1) Inverse momentum theory, 2) Actuator disc theory, 3) Numerical optimisation and 4) Quasi-3D CFD computations. The two former methods are based on 3D CFD computations and wind tunnel measurements on a 41 m full-scale rotor with LM 19.1 blades. The derived airfoil characteristics show that the lift coefficient in stall at the tip is low and that it is high at the root compared to 2D airfoil characteristics. The use of these characteristics in aeroelastic calculations shows a good agreement in power and flap moments with measurements. Furthermore, a fatigue analysis shows a reduction in the loads of up to 15% compared to a commonly used set of airfoil characteristics. The numerical optimisation is based on both the 3D CFD computations and measurements on a 41 m rotor with LM 19.1 and LM 19.0 blades, respectively. The method requires power and loads from a turbine and is promising since a set of lift and drag curves is derived that can be used to calculate mean values of power and loads. The lift in stall at the tip is low and at the root it is high compared to 2D airfoil characteristics. In particular the power curves were well calculated by use of the optimized airfoil characteristics. In the quasi-3D CFD computations, the airfoil characteristics are derived directly. This Navier-Stokes model takes into account rotational and 3D effects. The model enables the study of the rotational effect of a rotor blade at computing costs similar to what is typical for 2D airfoil calculations. The depicted results show that the model is capable of determining the correct qualitative behaviour for airfoils subject to rotation. The method shows that lift is high at the root compared to 2D airfoil characteristics. The different systematic methods show the importance of rotational and 3D effects on rotors. Furthermore, the methods show high lift coefficients in stall at the inboard part of the blade and low lift coefficients in stall at the outboard part of the blade compared to 2D wind tunnel measurements.

NTIS

Airfoils; Wind Turbines; Wind Tunnel Tests; Computational Fluid Dynamics

20000101662 NASA Ames Research Center, Moffett Field, CA USA
Review of Compressible Dynamic Stall and Its Control
Chandrasekhara, M. S., Naval Postgraduate School, USA; [1999]; 4p; In English; 8th; 8th Asian Congress of Fluid Mechanics, 6-10 Dec. 1999, Shenzhen, China
Contract(s)/Grant(s): RTOP 519-20-22; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A review of compressibility effects on dynamic stall of pitching airfoils and unsteady separation control by manipulation of unsteady vorticity using a deformable leading edge airfoil design is presented.
Author
Compressibility Effects; Aerodynamic Stalling; Airfoils

20000103553 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA
A Novel Method for Reducing Rotor Blade-Vortex Interaction *Final Report, 1 Aug. 1995 - 31 Jul. 1999*
Glinka, A. T., Arizona State Univ., USA; [2000]; 28p; In English
Contract(s)/Grant(s): NGT2-52204; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

One of the major hindrances to expansion of the rotorcraft market is the high-amplitude noise they produce, especially during low-speed descent, where blade-vortex interactions frequently occur. In an attempt to reduce the noise levels caused by blade-vortex interactions, the flip-tip rotor blade concept was devised. The flip-tip rotor increases the miss distance between the shed vortices and the rotor blades, reducing BVI noise. The distance is increased by rotating an outboard portion of the rotor tip either up or down depending on the flight condition. The proposed plan for the grant consisted of a computational simulation of the rotor aerodynamics and its wake geometry to determine the effectiveness of the concept, coupled with a series of wind tunnel experiments exploring the value of the device and validating the computer model. The computational model did in fact show that the miss distance could be increased, giving a measure of the effectiveness of the flip-tip rotor. However, the wind experiments were not able to be conducted. Increased outside demand for the 7'x lO' wind tunnel at NASA Ames and low priority at Ames for this project forced numerous postponements of the tests, eventually pushing the tests beyond the life of the grant. A design for the rotor blades to be tested in the wind tunnel was completed and an analysis of the strength of the model blades based on predicted loads, including dynamic forces, was done.
Author
Blade-Vortex Interaction; Computerized Simulation; Rotor Aerodynamics; Noise Reduction; Flight Conditions; Noise Intensity

20000104735 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Characterization and Control of Vortex Breakdown over a Delta Wing at High Angles of Attack
Mitchell, Anthony M.; Aug. 08, 2000; 380p; In English
Report No.(s): AD-A381005; No Copyright; Avail: CASI; A17, Hardcopy; A03, Microfiche

Demands for more maneuverable and stealthy air vehicles have encouraged the development of new control concepts for separated flows. The goal of this research is the control of leading-edge vortex breakdown by open-loop, along-the-core blowing near the apex of a delta wing to improve lift and maneuverability at high angles of attack. Control is dependent on the knowledge of and the ability to detect principle characteristics of the phenomena. Therefore, an experimental study of a 700 delta wing was accomplished to better understand the physical properties of the vortical flow and the vortex breakdown phenomena. Multiple experimental methods were used to characterize the flow field and its influence on the model's surfaces as well as to identify parameters for closed-loop feedback control.
DTIC
Vortex Breakdown; Separated Flow; Leading Edges; Feedback Control; Delta Wings; Boundary Layer Control; Boundary Layer Separation

20000104835 Aerospace Corp., El Segundo, CA USA
An Improved Procedure for Combining Day-of-Launch Atmospheric Flight Loads *Final Report*
Binkley, J. F.; Clark, J. B.; Spiekermann, C. E.; Jul. 1999; 21p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A381097; ATM-TR,99(1534)-3; SMC-TR-00-22; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An improved procedure for combining launch vehicle atmospheric flight load contributors is presented. This new procedure produces load-to-allowable value ratios with lower bias and less variance than previously used procedures. It is expected that the new procedure will increase launch availability without reducing launch reliability.
DTIC
Launch Vehicles; Static Loads; Monte Carlo Method; Aerodynamic Loads; Rigid Structures; Structural Reliability

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation.

20000094468 Naval Postgraduate School, Monterey, CA USA
Helicopter Urban Navigation Training Using Virtual Environments
Wright, George T., Jr; Jun. 2000; 149p; In English
Report No.(s): AD-A379671; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Helicopter missions are never defined as "...successful navigation to and return from a location." Navigation, in and of itself, is not the mission - it is, however, a skill that all helicopter pilots are expected to master in order to function as pilots. Navigation is a means to an end. Helicopter operations, being inherently expensive and unforgiving of mistakes, are prime candidates for such innovative training techniques as virtual (3-D) fly-throughs. This thesis, as a logical extension of previous research, seeks out ways to enhance current training methods for urban helicopter navigation using state-of-the-art-technology. Using empirical data from pilot surveys and controlled experiments, principles can be formulated to determine the level of computer graphics fidelity necessary for helicopter crews to conduct a virtual flight in an urban setting that is a credible, effective tool in preparation of an actual flight. This research does not seek a replacement method of training helicopter terrain navigation - pilots must still be taught the fundamental skills of map interpretation and terrain association using conventional training techniques. However, it is the intent of this research to explore methods of enhancing and supplementing site - specific helicopter navigation training through the transfer of spatial knowledge from the virtual world to real-world applications.
DTIC
Air Navigation; Helicopters; Pilot Training; Training Simulators; Virtual Reality

20000094543 Naval Postgraduate School, Monterey, CA USA
Optimal Parachute Guidance, Navigation, and Control for the Affordable Guided Airdrop System (AGAS)
Williams, Timothy A.; Jun. 2000; 123p; In English
Report No.(s): AD-A380301; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This study is a continuation of a previous work concerning the Affordable Guided Airdrop System (AGAS), a parachute system that integrates low-cost guidance and control into fielded cargo air delivery systems. This thesis sought to expand upon the previous study and provide more information and research on this innovative and critical military system. Several objectives and tasks were completed in the course of this research and development. The simulation model used in the previous work for feasibility and analysis studies was moved from a MATLAB/SIMULINK environment to a MATRIX-X environment in anticipation of AGAS future use on an integrated Systems, Incorporated AC-104 real-time controller. Further simulation and study for this thesis were performed on the new system. The new model implemented characteristics of the G-12 parachute, which eventually will be used in the actual flight testing of the AGAS airdrop. The system of pneumatic muscle actuators (PMAs) built by Vertigo, Incorporated and used on the AGAS was modeled on the computer also. The characteristics of this system and their effects on AGAS guidance and control were studied in depth. The control concept of following a predicted trajectory based on certain wind predictions and other ideas for control algorithms to minimize fuel gas usage, number of control actuation and final control error were also studied. Conclusions and recommendations for further study were drawn from this project.
DTIC
Parachutes; Computerized Simulation; Air Drop Operations; Controllers; Feasibility Analysis; Flight Tests; Air Navigation; Real Time Operation

20000095640 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Mission Route Planning with Multiple Aircraft & Targets Using Parallel A* Algorithm
Sezer, Ergin; Mar. 21, 2000; 166p; In English

Report No.(s): AD-A380911; AFIT/GCE/ENG/00M-04; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The general Mission Route Planning (MRP) Problem is the process of selecting an aircraft flight path in order to fly from a starting point through defended terrain to target(s), and return to a safe destination. MRP is a three-dimensional, multi-criteria path search. Planning of aircraft routes involves an elaborate search through numerous possibilities, which can severely task the resources of the system being used to compute the routes. Operational systems can take up to a day to arrive at a solution due to the combinatorial nature of the problem, which is not acceptable, because time is critical in aviation. Also, the information that the software is using to solve the MRP may become invalid during the computation. An effective and efficient way of solving the MRP with multiple aircraft and multiple targets is desired using parallel computing techniques. Processors find the optimal solution by exploring in parallel the MRP search space. With this distributed decomposition the time required for an optimal solution is reduced as compared to a sequential version. We have designed an effective and scalable MRP solution using a parallelized version of the A* search algorithm. Efficient implementation and extensive testing was done using MPI on clusters of workstations and PCs.

DTIC

Flight Paths; Mission Planning; Algorithms; Parallel Processing (Computers)

20000096225 Naval Postgraduate School, Dept. of Operations Research, Monterey, CA USA

Evaluating Demographic Item Relationships With Survey Responses on the Maintenance Climate Assessment Survey (MCAS)

Stanley, Bruce R., Jr; Jun. 2000; 111p; In English

Report No.(s): AD-A380379; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Maintenance Climate Assessment Survey (MCAS) was developed to proactively assess factors that contribute to a high reliability organization and strong safety climate. The 3rd Marine Air Wing (MAW), which was seeking to proactively improve its safety posture requested the assistance of the School of Aviation Safety at the Naval Postgraduate School to examine its safety climate. Previous studies of the MCAS instrument have focused on the items and their relationship to the HRO based model of safety effectiveness components: process auditing, reward system, quality assurance, risk management, command and control, and communication/functional relationships. The present effort is the first attempt to consider the relationship between item component responses and demographic item responses. It evaluates 893 maintainer responds to the MCAS from 3rd MAW and looks for measurable effects due to demographics. This study finds that the regression models constructed using the demographics as explanatory variables have very little utility in predicting scores for the components. This result allows planners the relief of using the demographics as a low priority issue.

DTIC

Demography; Surveys; Human Factors Engineering; Factor Analysis

20000096254 National Transportation Safety Board, Washington, DC USA

National Transportation Safety Board Transportation Initial Decisions and Orders and Board Opinions and Orders Adopted and Issued during the Month of May 2000

May 2000; 230p

Report No.(s): PB2000-916705; NTSB/IDBOO-00/05; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This publication contains all Judge Initial Decisions and Board Opinions and Orders in Safety and Seaman Enforcement Cases for May 2000.

NTIS

Transportation; Air Transportation; Accident Prevention

20000097573 Massachusetts Inst. of Tech., International Center for Air Transportation, Cambridge, MA USA

Generalized Philosophy of Alerting with Applications for Parallel Approach Collision Prevention, *1 Apr. 1999 - 31 May 2000*

Winder, Lee F., Massachusetts Inst. of Tech., USA; Kuchar, James K., Massachusetts Inst. of Tech., USA; August 2000; 54p; In English

Contract(s)/Grant(s): NAG1-2189

Report No.(s): ICAT-2000-5; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The goal of the research was to develop formal guidelines for the design of hazard avoidance systems. An alerting system is automation designed to reduce the likelihood of undesirable outcomes that are due to rare failures in a human-controlled system. It accomplishes this by monitoring the system, and issuing warning messages to the human operators when thought necessary to head off a problem. On examination of existing and recently proposed logics for alerting it appears that few commonly accepted

principles guide the design process. Different logics intended to address the same hazards may take disparate forms and emphasize different aspects of performance, because each reflects the intuitive priorities of a different designer. Because performance must be satisfactory to all users of an alerting system (implying a universal meaning of acceptable performance) and not just one designer, a proposed logic often undergoes significant piecemeal modification before gamma general acceptance. This report is an initial attempt to clarify the common performance goals by which an alerting system is ultimately judged. A better understanding of these goals will hopefully allow designers to reach the final logic in a quicker, more direct and repeatable manner. As a case study, this report compares three alerting logics for collision prevention during independent approaches to parallel runways, and outlines a fourth alternative incorporating elements of the first three, but satisfying stated requirements. Three existing logics for parallel approach alerting are described. Each follows from different intuitive principles. The logics are presented as examples of three "philosophies" of alerting system design.
Derived from text
Collision Avoidance; Prevention; Hazards

20000097916 National Transportation Safety Board, Washington, DC USA
Federal Plan for Aviation Accidents Involving Aircraft Operated by or Chartered by Federal Agencies
Oct. 07, 1999; 28p; In English; Original contains color illustrations
Report No.(s): PB2000-107753; NTSB/SPC-99-04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This plan assigns responsibilities and describes the Federal response to a government aircraft accident involving fatalities and/or injuries. It is the basic document for agencies which have been given responsibilities under this plan. It is recommended that each agency conduct an analysis based upon the agency mission and susceptibility to becoming involved in a government aviation accident. Depending on the outcome of the analysis, agencies should develop a plan supporting and augmenting this guidance and establish procedures to meet the requirements of their agency.
NTIS
Aircraft Accidents; Governments

20000102604 International Trade Commission, Office of Industries, Washington, DC USA
Changing Structure of the Global Large Civil Aircraft Industry and Market: Implications for the Competitiveness of the US Industry. Investigation No. 332-384
Colby, H. M.; Falls, Z. T.; Lehey, K. S.; McNey, D. A.; November 1998; 232p; In English
Report No.(s): PB2000-107660; USITC/PUB-3143; No Copyright; Avail: CASI; A03, Microfiche; A11, Hardcopy

On September 23, 1997, at the request of the House Committee on Ways and Means, the USA International Trade Commission instituted investigation No. 332-384 for the purpose of exploring recent developments in the global large civil aircraft (LCA) industry and market. includes the following information: A description of changes in the structure of the global LCA industry, including the Boeing-McDonnell Douglas merger, the restructuring of Airbus Industries, the emergence of Russian producers, and the possibility of Asian parts suppliers forming consortia to manufacture complete airframes; A description of developments in the global market for aircraft, including the emergence of regional jet aircraft and proposed jumbo jets, and issues involving Open Skies and free flight; A description of the implementation and status of the 1992 US-EU Large Civil Aircraft Agreement; A description of other significant developments that affect the competitiveness of the US LCA industry; and An analysis of the aforementioned structural changes in the LCA industry and market to assess the impact of these changes on the competitiveness of the US LCA industry. For the last 50 years, the USA has been the leading supplier of LCA to the world. Changes in the structure of the global LCA industry and its market may ultimately affect the US industry's continued dominance, as competition increases and aspiring producers seek to enter the market.
NTIS
Aircraft Industry; Aircraft Structures; Market Research

20000103540 Civil Aeromedical Inst., Oklahoma City, OK USA
The Computerized Analysis of ATC Tracking Data for an Operational Evaluation of CDTI/ADS-B Technology ***Final Report***
Mills, Scott H., Civil Aeromedical Inst., USA; September 2000; 16p; In English
Contract(s)/Grant(s): AM-B-00-HRR-516
Report No.(s): DOT/FAA/AM-00/30; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1999, the Cargo Airlines Association and the Federal Aviation Administration conducted an operational evaluation (OpEval) of cockpit Display of traffic Information (CDTI) and Automatic Dependent Surveillance - Broadcast (ADS-B) technologies at the Airborne Express Airpark in Wilmington, Ohio. This evaluation was designed to demonstrate the benefits of

CDTI, including safety, efficiency, and capacity. The evaluation included 13 aircraft of various types and their flight crews. The aircraft flew multiple flight patterns during the morning and the afternoon of a single day. Each traffic pattern flown by each aircraft was assigned to either the CDTI or baseline (no CDTI) condition. Human factors observers recorded data from the flight decks and the control tower. In addition, air traffic control (ATC) data were recorded by the participating ATC facilities. An important part of the analysis of such a demonstration is the examination of objective flight data. Because of the complexity of the OpEval, new computerized analysis techniques were developed and conducted. This paper describes those techniques in detail, as well as the results of the analysis. Methods such as those described here will be increasingly important as new technologies are developed and evaluated operationally.
Author
Human Factors Engineering; Computer Techniques; Airline Operations; Display Devices; Commercial Aircraft

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control.

20000095555 Michigan Univ., Transportation Research Inst., Ann Arbor, MI USA
Navigation System Data Entry: Estimation of Task Times
Green, P.; Jul. 1999; 54p; In English
Report No.(s): PB2000-106945; UMTRI-99-17; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report proposes a method (for SAE Recommended Practice J2365) to estimate in-vehicle task times and reviews the related human factors literature. This method will be used to evaluate alternative driver interface designs and to check compliance with the 15-second task time limit specified in SAE Recommended Practice J2364 (Navigation Function Access While Driving). Application of this method will enhance the safety and usability of driver information systems. A review of the human factors literature (Kurokawa's dissertation, Levison's Integrated Driver Model, the NASA MIDAS software, the Integrated Performance Modeling Environment, etc.) revealed that there was no personal computer software available or hand calculation methods tailored for this purpose. Therefore, the approach taken was to extend the Keystroke-Level Model (popular in human-computer interaction) using data from automotive navigation studies for calibration.
NTIS
Information Systems; Navigation; Human Factors Engineering

20000095573 NASA Goddard Space Flight Center, Greenbelt, MD USA
On Fast Post-Processing of Global Positioning System Simulator Truth Data and Receiver Measurements and Solutions Data
Kizhner, Semion, NASA Goddard Space Flight Center, USA; [2000]; 2p; In English; 13th; Global Positioning System, 19-22 Sep. 2000, Salt Lake City, UT, USA; Sponsored by American Inst. of Navigation, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Post-Processing of data related to a Global Positioning System (GPS) simulation is an important activity in qualification of a GPS receiver for space flight. Because a GPS simulator is a critical resource it is desirable to move off the pertinent simulation data from the simulator as soon as a test is completed. The simulator data files are usually moved to a Personal Computer (PC), where the post-processing of the receiver logged measurements and solutions data and simulated data is performed. Typically post-processing is accomplished using PC-based commercial software languages and tools. Because of commercial software systems generality their general-purpose functions are notoriously slow and more than often are the bottleneck problem even for short duration experiments. For example, it may take 8 hours to post-process data from a 6-hour simulation. There is a need to do post-processing faster, especially in order to use the previous test results as feedback for a next simulation setup. This paper demonstrates that a fast software linear interpolation algorithm is applicable to a large class of engineering problems, like GPS simulation data post-processing, where computational time is a critical resource and is one of the most important considerations. An approach is developed that allows to speed-up post-processing by an order of magnitude. It is based on improving the post-processing bottleneck interpolation algorithm using apriori information that is specific to the GPS simulation application. The presented post-processing scheme was used in support of a few successful space flight missions carrying GPS receivers. A

future approach to solving the post-processing performance problem using Field Programmable Gate Array (FPGA) technology is described.
Author
Data Processing; Global Positioning System; Simulation; Software Engineering; Computer Programs; Computer Systems Performance; Response Time (Computers)

20000095614 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Design and Validation of an Accurate GPS Signal and Receiver Truth Model for Comparing Advanced Receiver Processing Techniques
Mar. 2000; 225p; In English
Report No.(s): AD-A380760; AFIT/GE/ENG/00M-07; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Recent increases in the computational power of computers and digital signal processors have made possible new, novel signal tracking techniques in GPS receivers. One such technique is known as Direct Correlators Output Processing (DCOP). This technique replaces individual traditional tracking loops with a single Kalman Filter, which jointly processes the received signals while exploiting their correlated noises. DCOP is innovative in its potential to replace the tried and true classical signal tracking loops. It is also an enabling technology for ultra-tightly coupled GPS/INS (Global Positioning System/Inertial Navigation System). Potential benefits of these new tracking techniques include an order-of-magnitude improvement in positional accuracy in environments of jamming and high dynamics. However, such performance gains are typically based on software simulations of conceptual GPS receiver designs, not working prototypes. Simulating these new designs requires the modeling of GPS signals and receiver tracking loops, instead of the traditional pseudorange and carrier-phase measurements, which many proven GPS simulation software packages accurately model. The purpose of this research has been to develop an accurate, user-friendly, and customizable GPS signal and receiver model to use for a fair and unbiased evaluation of advanced receiver designs. The result of this research is a Matlab GPS signal simulator, QR a Simulink GPS receiver model implementing true receiver DSP processing, and a Matlab high-speed signal/receiver model that approximates the signal simulator and receiver model.
DTIC
Signal Processing; Global Positioning System; Inertial Navigation; Design Analysis; Applications Programs (Computers); Proving

20000095615 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Evaluation of a Method for Kinematic GPS Carrier-Phase Ambiguity Resolution Using a Network of Reference Receivers
Bracy, Brian L.; Mar. 2000; 77p; In English
Report No.(s): AD-A380761; AFIT/GE/ENG/00M-05; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

New applications for GPS have driven a demand for increased positioning accuracy. The emerging GPS technology particularly affects the test community. The testing equipment and method must provide a solution that is an order of magnitude more precise than the tested equipment to achieve the desired accuracy. Carrier-phase differential GPS methods using a network of reference receivers can provide the centimeter-level accuracy required over a large geographical area. This thesis evaluates the performance of a 5-receiver network over a 50 km x 120 km area of New Mexico, using a GPS network algorithm called NetAdjust. The percentage of time a fixed integer solution was available for a kinematic baseline was investigated for three types of measurements. Results showed that the virtual reference receiver method using NetAdjust-corrected measurements outperformed the raw and NetAdjust-corrected file results. However, these results were only obtained for the shortest baseline receivers. The receivers with longer baselines did not experience the same degree of success, but did lead to several important insights gained from the research. Most importantly, the accuracy of the reference receiver coordinates is critical to the performance of a reference receiver network. Further testing must be accomplished before a full implementation is recommended.
DTIC
Signal Processing; Global Positioning System; Evaluation; Algorithms; Positioning

20000096178 Department of Defense, Office of the Inspector General, Arlington, VA USA
Ground Control Approach-2000 Radar System Test Plan and Test Results
Jul. 20, 2000; 28p; In English
Report No.(s): AD-A379662; IG/DOD-D-2000-163; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is a review of the test plans and test results of the Ground Control Approach-2000 (GCA-2000) radar system. On October 24, 1997, the Air Force Materiel Command, Electronic Systems Center, awarded a contract to ITT Gilfillan for three GCA-2000 radar systems. The firm-fixed-price contract with an estimated value of $9.6 million was awarded on a sole-source basis under the authority of Federal Acquisition Regulation 6.302-2, "Unusual and Compelling Urgency." The first system was

delivered 2 months late in October 1998. An operational utility evaluation followed the delivery of the first system. The evaluation revealed 85 deficiencies. The deficiencies were corrected with the exception of three reliability deficiencies, which were being worked at the time of this report.
DTIC
Ground Based Control; Electronic Equipment; Radar; Computer Program Integrity

20000097372 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Stochastic Modeling-Based DGPS Estimation Algorithm
Broaddus, James T.; Mar. 2000; 82p; In English
Report No.(s): AD-A380719; AFIT/GE/ENG/00M-06; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
A Kinematic Differential Global Positioning System (KDGPS) algorithm is developed. A number of mobile receivers is considered, one of which will be designated the
DTIC
Algorithms; Global Positioning System; Kinematics; Stochastic Processes

20000097581 NASA Marshall Space Flight Center, Huntsville, AL USA
The Video Guidance Sensor: Space, Earth, Ground, and Sea
Howard, Richard T., NASA Marshall Space Flight Center, USA; Bryan, Thomas c., NASA Marshall Space Flight Center, USA; Book, Michael L., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Advances in Navigation Guidance and Control Technology Workshop, 1-2 Nov. 2000, Redstone Arsenal, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only
Engineers at the Marshall Space Flight Center (MSFC) have been developing and testing video-based sensors for automated spacecraft guidance for several years. The next generation of Video Guidance Sensor (VGS) is being designed to be faster and more capable than ever. It will have applications to relative position measurement in any field of endeavor. The system works by sequentially firing two different wavelengths of laser diodes at the target (which has retroreflectors) and processing the two images. Since the target only reflects one wavelength, it shows up well in one image and not at all in the other. Because the target's dimensions are known, the relative positions and attitudes of the target and the sensor can be computed from the spots reflected from the target. The current sensor operates at 5 Hz at ranges from 1 to 110 meters with a 20 deg. field-of-view. The Video Guidance Sensor (VGS) developed over the past several years has performed well in testing and met the objective of being used as the terminal guidance sensor for an automated rendezvous and capture system. The first VGS was successfully tested in closed-loop 3-degree-of-freedom (3-DOF) tests in 1989 and then in 6-DOF open-loop tests in 1992 and closed-loop tests in 1993-4. Development and testing continued, and in 1995 approval was given to test the VGS in an experiment on the Space Shuttle. The VGS flew in 1997 and in 1998, performing well during both flight experiments. During the development and testing before, during, and after the flight experiments, numerous areas for improvement were found. The next generation of VGS is being designed to operate at up to 100 Hz tracking rates and at ranges from 0.5 to 200 meters. In addition to its use as a spacecraft guidance sensor, it could be used as an alignment aid for an operator of a remote system (giving position and attitude feedback data), as a feedback system for a robotic arm, or for automated vehicle guidance. The next generation VGS, with its higher tracking rates, smaller size, and lower power could be used in more places than the original VGS, and by using LED's instead of laser diodes, the system would be eye-safe at any range. More potential applications include aerial station keeping (keeping 2 or more autonomous aircraft within particular relative positions), under-water robotics, and the guidance of ground vehicles in predefined areas equipped with sets of targets.
Author
Automatic Control; Guidance Sensors; Spacecraft Guidance; Video Signals

20000097961 NASA Goddard Space Flight Center, Greenbelt, MD USA
Testing Results of the X-38 Crew Return Vehicle GPS Receiver
Simpson, James, NASA Goddard Space Flight Center, USA; Campbell, Charles, NASA Goddard Space Flight Center, USA; Lightsey, E. Glenn, Texas Univ., USA; [2000]; 1p; In English; Institute of Navigation (ION) GPS Conference, 19-22 Sep. 2000, Salt Lake City, UT, USA; No Copyright; Avail: Issuing Activity; Abstract Only
The X-38 Crew Return Vehicle (CRV) utilizes a Space Integrated GPS/INS (SIGI) sensor to obtain navigation and attitude knowledge. Testing and analysis at the NASA Goddard Space Flight Center Guidance, Navigation, and Control's GPS Lab was conducted in order to validate the development of SIGI GPS receiver attitude firmware. The modifications to the International Space Station (ISS) SIGI receiver that were completed to meet the CRV requirements will be presented. The CRV is designed to be used as a life-boat in case of an emergency evacuation from the ISS. The need to return the ISS crew in a timely manner

places challenging performance requirements on the SIGI sensor. This paper will summarize the performance of the SIGI GPS receiver for the CRV. The ability to track the GPS signals at any initial attitude and the performance of the SIGI GPS-only solution during reentry are detailed in this paper. A discussion regarding the use of the Global Satellite Systems GPS Signal Generator in testing the SIGI sensor will provide insight into the GPS validation process used at NASA Goddard.
Author
Global Positioning System; Receivers; Signal Generators; X-38 Crew Return Vehicle; Space Navigation; Spacecraft Instruments; Performance Tests; Space Flight

20000097963 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Real Time Differential GPS Tracking System for NASA Sounding Rockets
Bull, Barton, NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; Institute of Navigation (ION) GPS-2000 Conference, 19-22 Sep. 2000, Salt Lake City, UT, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Sounding rockets are suborbital launch vehicles capable of carrying scientific payloads to several hundred miles in altitude. These missions return a variety of scientific data including: chemical makeup and physical processes taking place in the atmosphere, natural radiation surrounding the Earth, data on the Sun, stars, galaxies and many other phenomena. In addition, sounding rockets provide a reasonably economical means of conducting engineering tests for instruments and devices to be used on satellites and other spacecraft prior to their use in these more expensive missions. Typically around thirty of these rockets are launched each year, from established ranges at Wallops Island, Virginia; Poker Flat Research Range, Alaska; White Sands Missile Range, New Mexico and from a number of ranges outside the USA. Many times launches are conducted from temporary launch ranges in remote parts of the world requiring considerable expense to transport and operate tracking radars. In order to support these missions, an inverse differential GPS system has been developed. The flight system consists of a small, inexpensive receiver, a preamplifier and a wrap-around antenna. A rugged, compact, portable ground station extracts GPS data from the raw payload telemetry stream, performs a real time differential solution and graphically displays the rocket's path relative to a predicted trajectory plot. In addition to generating a real time navigation solution, the system has been used for payload recovery, timing, data timetagging, precise tracking of multiple payloads and slaving of optical tracking systems for over the horizon acquisition. This paper discusses, in detail, the flight and ground hardware, as well as data processing and operational aspects of the system, and provides evidence of the system accuracy.
Author
Global Positioning System; Real Time Operation; Sounding Rockets; Data Acquisition; Optical Tracking; Systems Engineering

20000099683 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Measurement of Geopotential Heights by GPS Radio Occultation
Leroy, Stephen S., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Mar. 27, 1997; ISSN 0148-0227; Volume 102, No. D6, pp. 6971-6986; In English; Original contains color illustrations
Report No.(s): Paper-96JD03083; Copyright; Avail: Issuing Activity

Geopotential heights of constant pressure surfaces are retrieved from global positioning system (GPS) radio occultation data. In order to assess accuracy a subset of data obtained by GPS/MET during spring 1995 and summer 1995 are compared to the output of the European Centre for Medium-Range Weather Forecasts (ECMWF) global model. The root-mean-square measurement error is 20 m throughout the upper troposphere and lower stratosphere. Furthermore, the ECMWF global model contains enhanced errors in the southeast Pacific. In probing the data for potential utility in climate studies, a Bayesian interpolation technique is used to map the geopotential height fields in the upper troposphere during the summer. Despite limitations of the GPS/MET data set the global average 300-mbar geopotential height over a 2-week period in summer 1995 is determined with an accuracy of 7 m. by obtaining greater coverage and partially resolving synoptic variability, a future constellation of 16 orbiting receivers could obtain global average geopotential height estimates in the upper troposphere with an accuracy of 1 m each day. Accuracy would be somewhat worse for regional studies, except in the tropics where synoptic variability is depressed.
Author
Geopotential Height; Atmospheric Pressure; Global Positioning System; Radio Occultation

20000102237 Minnesota Univ., Dept. of Mechanical Engineering, Minneapolis, MN USA
Differential GPS Based Control of Heavy Vehicles *Final Report, 1998-1999*
Alexander, L.; Donath, M.; Jan. 1999; 94p; In English
Report No.(s): PB2000-106649; MN/RC-2000-05; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

This report describes the development of technologies that safely steer a vehicle if the vehicle's driver becomes incapacitated. A Differential Global Positioning System (GPS) senses the vehicle's position and velocity. This method seems to offer adequate

precision with a low-enough infrastructure cost to make the system practical in most rural settings. Researchers used a heavy vehicle--a class 8 truck tractor--partly because of the most favorable economics associated with installation of this type of system on a commercial vehicle, and partly because of the commercial driver's higher exposure to conditions that engender drowsy driving. This research examines two potential applications of the steering, throttle, and brake controllers. The first, a virtual rumble strip, vibrates the wheel whenever the vehicle drifts out of its lane. The second, a system senses the erratic steering that presages loss of consciousness, and then takes control of the vehicle, pulling it over to a safe stop.
NTIS
Speed Control; Lateral Control; Longitudinal Control; Automatic Control

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology.

20000094448 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Integrating Automated Multi-Disciplinary Optimization in Preliminary Design of Non-Traditional Aircraft
Fidanci, Mehmet; Miller, Jeffrey R.; Strauss, Douglas J.; Mar. 2000; 224p; In English
Report No.(s): AD-A380252; AFIT/GSE/ENY/00M-01; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Current methods of aircraft conceptual design lack the ability to quickly generate detailed analysis, particularly of nontraditional designs such as blended wing body craft. This study developed a method to resolve this problem by creating a flexible, parametrically driven conceptual model in an object-oriented, adaptive modeling environment from which analysis and optimization may rapidly be performed. These object-oriented techniques are incorporated into a traditional conceptual design process. All objects inherit dependency-tracking and demand-driven calculations. Design Analysis was performed within the modeling language and utilized interfaces to other software packages. A detailed mesh, suitable for input into finite element analysis programs, was developed from the less detailed, geometric mesh created by the modeling program. The output from finite element analysis forms the basis for rapid changes in subsequent iterations of the design process. The demonstration focuses on a single parametric design model which transforms a conventional transport design into a blended wing body design. This single design is controlled by a limited - set of geometric variables and produces optimal structural weight estimations while the designer addresses volumetric and cost requirements.
DTIC
Aircraft Design; Design Analysis; Finite Element Method; Object-Oriented Programming; Computer Aided Design

20000094464 Eagle-Picher Industries, Inc., Electronics Div., Colorado Springs, CO USA
Advanced Battery System for Aircraft *Final Report, Jun. 1986 - Jun. 1995*
Johnson, Za; Jun. 1995; 57p; In English
Contract(s)/Grant(s): F33615-86-C-2678; AF Proj. 3145
Report No.(s): AD-A380292; AFRL-PR-WP-TR-2000-2050; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The deliverable systems are designed to have maintenance free operation for 3 years or 1000 flight hours. The goal of achieving a sealed NiCd battery and a microprocessor controlled charger was also met. Although the contract scheduling required ELDEC and EPI to perform much of the battery and charger development in parallel, at program end an integrated and reliable system was delivered. Trade-offs were performed during the development of the hardware. In the case of the Advanced Battery System a listing of lessons learned or recommendations is presented.
DTIC
Battery Chargers; Maintenance; Electric Batteries

20000094842 Virginia Polytechnic Inst. and State Univ., Dept. of Engineering Science and Mechanics, Blacksburg, VA USA
Resin Film Infusion (RFI) Process Modeling for Large Transport Aircraft Wing Structures *Final Report, 10 Dec. 1997 - 9 Dec. 1998*
Knott, Tamara W., Virginia Polytechnic Inst. and State Univ., USA; Loos, Alfred C., Virginia Polytechnic Inst. and State Univ., USA; Aug. 15, 2000; 74p; In English
Contract(s)/Grant(s): NAG1-1881; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Resin film infusion (RFI) is a cost-effective method for fabricating stiffened aircraft wing structures. The RFI process lends itself to the use of near net shape textile preforms manufactured through a variety of automated textile processes such as knitting

and braiding. Often, these advanced fiber architecture preforms have through-the-thickness stitching for improved damage tolerance and delamination resistance. The challenge presently facing RFI is to refine the process to ensure complete infiltration and cure of a geometrically complex shape preform with the high fiber volume fraction needed for structural applications. An accurate measurement of preform permeability is critical for successful modeling of the RFI resin infiltration process. Small changes in the permeability can result in very different infiltration behavior and times. Therefore, it is important to accurately measure the permeabilities of the textile preforms used in the RFI process. The objective of this investigation was to develop test methods that can be used to measure the compaction behavior and permeabilities of high fiber volume fraction, advanced fiber architecture textile preforms. These preforms are often highly compacted due to through-the-thickness stitching used to improve damage tolerance. Test fixtures were designed and fabricated and used to measure both transverse and in-plane permeabilities. The fixtures were used to measure the permeabilities of multiaxial warp knit and triaxial braided preforms at fiber volume fractions from 55% to 65%. In addition, the effects of stitching characteristics, thickness, and batch variability on permeability and compaction behavior were investigated.
Derived from text
Aircraft Structures; Resin Film Infusion; Transport Aircraft; Wings; Permeability; Fabrication; Textiles; Models

20000095076 NASA Dryden Flight Research Center, Edwards, CA USA
Design and Predictions for High-Altitude (Low Reynolds Number) Aerodynamic Flight Experiment
Greer, Donald, NASA Dryden Flight Research Center, USA; Harmory, Phil, NASA Dryden Flight Research Center, USA; Krake, Keith, Sparta, Inc., USA; Drela, Mark, Massachusetts Inst. of Tech., USA; July-August 2000; 6p; In English
Contract(s)/Grant(s): NCC2-374; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

A sailplane being developed at NASA Dryden Flight Research Center will support a high-altitude flight experiment. The experiment will measure the performance parameters or an airfoil at high altitudes (70,000 - 100,000 ft), low Reynolds numbers (2 x 10(exp 5) - 7 x 10(exp 5)), and high subsonic Mach numbers (0.5 and 0.65). The airfoil section lift and drag are determined from pilot and static pressure measurements. The locations of the separation bubble, Tollmien-Schlichting boundary-layer instability frequencies, and vortex shedding are measured from a hot-film strip. The details of the planned flight experiment are presented as well as several predictions of the airfoil performance.
Author
Performance Tests; Aerodynamic Drag; High Altitude; Low Reynolds Number; Pressure Measurement; Flight Characteristics; Experiment Design

20000095616 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Realtime Color Stereovision Processing
Formwalt, Bryon P.; Mar. 2000; 117p; In English
Report No.(s): AD-A380765; AFIT/GE/ENG/00M-08; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Recent developments in aviation have made micro air vehicles (MAVs) a reality. These feather-weight palm-sized radio-controlled flying saucers embody the future of air-to-ground combat. No one has ever successfully implemented an autonomous control system for MAVs. Because MAVs are physically small with limited energy supplies, video signals offer superiority over radar for navigational applications. This research takes a step forward in real time machine vision processing. It investigates techniques for implementing a real time stereovision processing system using two miniature color cameras. The effects of poor-quality optics are overcome by a robust algorithm, which operates in real time and achieves frame rates up to 10 fps in ideal conditions. The vision system implements innovative work in the following five areas of vision processing: fast image registration preprocessing, object detection, feature correspondence, distortion-compensated ranging, and multi scale nominal frequency-based object recognition. Results indicate that the system can provide%adequate obstacle avoidance feedback for autonomous vehicle control. However, typical relative position errors are about 10%-to high for surveillance applications. The range of operation is also limited to between 6 - 30 m. The root of this limitation is imprecise feature correspondence: with perfect feature correspondence the range would extend to between 0.5 - 30 m. Stereo camera separation limits the near range, while optical resolution limits the far range. Image frame sizes are 160x120 pixels. Increasing this size will improve far range characteristics but will also decrease frame rate. Image preprocessing proved to be less appropriate than precision camera alignment in this application. A proof of concept for object recognition shows promise for applications with more precise object detection. Future recommendations are offered in all five areas of vision processing.
DTIC
Test Vehicles; Cameras; Stereoscopic Vision; Aerospace Vehicles; Computer Vision

20000095648 Department of Defense, Office of the Inspector General, Arlington, VA USA
V-22 Osprey Joint Advanced Vertical Aircraft
Gimble, Thomas F.; Ugone, Mary L.; Santoni, Charles M.; Shaffer, Robert L.; Hoyt, James A.; Aug. 15, 2000; 30p; In English
Report No.(s): AD-A380958; IG/DOD-D-2000-174; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The V-22 Osprey Joint Advanced Vertical Aircraft (V-22) is a tilt-rotor, short-take-off-and-landing aircraft, which was developed to fulfill multi-Service operational requirements. The V-22 operates as a helicopter for takeoffs and landings and, once airborne, converts to a turboprop aircraft. The V-22 acquisition is in the engineering, manufacturing, and development phase of the acquisition cycle and is scheduled for a Milestone III full-rate production decision in December 2000. The Program Manager, V-22 Osprey Joint Advanced Vertical Aircraft, manages the V-22 acquisition program under the Program Executive Officer, Air Anti-Submarine Warfare, Assault, and Special Mission Programs. As of December 31, 1999, the V-22 Program Management Office estimated that the total program cost for 458 V-22 aircraft (360 aircraft for the Marine Corps, 50 aircraft for the Air Force Special Operations Command, and 48 aircraft for the Navy) was $38.1 billion (then-year dollars).
DTIC
V-22 Aircraft; Helicopters; Tilt Rotor Aircraft; Turboprop Aircraft; Vertical Takeoff Aircraft

20000096221 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Modeling Piezoceramic Twist Actuation in Single-Cell Anisotropic Torque Box of Low-Observable UAV Wing
Cseke, Peter, Jr.; Mar. 2000; 183p; In English
Report No.(s): AD-A380370; AFIT/GAE/ENY/00M-4; No Copyright; Avail: Defense Technical Information Center (DTIC)

The reduction of an aircraft's radar cross section can increase its survivability in hostile airspace by making it more difficult to locate and track by enemy radar. Replacing articulated flight control surfaces with adaptive controls will reduce surface discontinuities, and enhance low observability. Actuation of the aerodynamic surfaces is achieved by an electric field applied to PZT actuators embedded in the top and bottom skins, creating differential strain and shear in the host substrate. This creates torsion about the elastic axis, and a change in the wing lift coefficient. The torsion of the designed baseline UAV's wing torque box was modeled in the presence of a full complement of air-loads by extending the Bredt-Batho theorem. This was accomplished through modifying Libove's method, using a thin-walled, linearly elastic, fully anisotropic, trapezoid cross-section beam. The linear tip twist angles due to a uniform cross-sectional moment were verified using the isotropic Bredt-Batho theorem, and published anisotropic results by applying isotropic, then anisotropic laminate elastic properties. The isotropic solutions were within 3.1%; the anisotropic results were within 6.9-10.9% of the published angles. The PZT actuation of the host structure was achieved by substituting the PZT-composite laminate elastic properties into the derived solution and inducing strain and shear of the PZT lamina by applying an electric field, without the presence of external forces or moments. Using two different PZT laminae, the angular twist as a function of the host lamina orientation angle and applied voltage was recorded. The amount of twist ranged between 0.03-0.39 degrees, and 0.12-1.04 degrees for the AFC and G-1195 PZT laminae respectively.
DTIC
Actuators; Piezoelectric Ceramics

20000096261 Army Aeromedical Research Lab., Fort Rucker, AL USA
Effects of Inadvertent UH-60 Cockpit Airbag System Deployment on Flight Control *Final Report*
Brozoski, Frederick; Johnson, Philip; Crowley, John; McEntire, Joseph; May 2000; 26p; In English
Report No.(s): AD-A378682; USAARL-2000-15; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two studies were undertaken to assess the effect of inadvertent deployments of a prototype UH-60 cockpit airbag system (CABS) on flight control. In Study One, the effects of inadvertent four-airbag (two forward and two lateral) CABS deployments were investigated; Study Two looked into the effects of inadvertent two-airbag (two forward airbags only) CABS deployments. In both studies, current and qualified UH-60 aviators were recruited to fly 1-hour sorties in an NUH-60 research flight simulator. Simulated inadvertent CABS deployments were introduced into these sorties during six predetermined flight maneuvers. The simulated deployments included uncommanded cyclic and collective motions, obstruction of the forward and lateral view screens, obstruction of the instrument panel, and an audible cue (used to crudely mimic airbag deployment noise). Data were collected on the probability of crashing, the time to recover from, or to crash as a result of, each simulated deployment, as well as on the severity of each simulated deployment as perceived by the test subjects, simulator operator, and simulator observer. Results show flight control to be more adversely affected by inadvertent deployment of the four-airbag CABS, particularly during high-speed, low-level flight.
DTIC
Air Bag Restraint Devices; UH-60A Helicopter; Flight Control; Flight Simulation

20000097941 Cornell Univ., School of Civil and Environmental Engineering, Ithaca, NY USA
Crack Turning in Integrally Stiffened Aircraft Structures *Final Report*
Petit, Richard Glen, Cornell Univ., USA; Ingraffea, Anthony R., Cornell Univ., USA; August 2000; 235p; In English
Contract(s)/Grant(s): NAG1-2268; Copyright; Avail: Issuing Activity

Current emphasis in the aircraft industry toward reducing manufacturing cost has created a renewed interest in integrally stiffened structures. Crack turning has been identified as an approach to improve the damage tolerance and fail-safety of this class of structures. A desired behavior is for skin cracks to turn before reaching a stiffener, instead of growing straight through. A crack in a pressurized fuselage encounters high T-stress as it nears the stiffener--a condition favorable to crack turning. Also, the tear resistance of aluminum alloys typically varies with crack orientation, a form of anisotropy that can influence the crack path. The present work addresses these issues with a study of crack turning in two-dimensions, including the effects of both T-stress and fracture anisotropy. Both effects are shown to have relation to the process zone size, an interaction that is central to this study. Following an introduction to the problem, the T-stress effect is studied for a slightly curved semi-infinite crack with a cohesive process zone, yielding a closed form expression for the future crack path in an infinite medium. For a given initial crack tip curvature and tensile T-stress, the crack path instability is found to increase with process zone size. Fracture orthotropy is treated using a simple function to interpolate between the two principal fracture resistance values in two-dimensions. An extension to three-dimensions interpolates between the six principal values of fracture resistance. Also discussed is the transition between mode I and mode II fracture in metals. For isotropic materials, there is evidence that the crack seeks out a direction of either local symmetry (pure mode 1) or local asymmetry (pure mode II) growth. For orthotropic materials the favored states are not pure modal, and have mode mix that is a function of crack orientation. Drawing upon these principles, two crack turning prediction approaches are extended to include fracture resistance orthotropy--a second-order linear elastic method with a characteristic length parameter to incorporate T-stress/process-zone effects, and an elastic-plastic method that uses the Crack Tip Opening Displacement (CTOD) to determine the failure response. Together with a novel method for obtaining enhanced accuracy T-stress calculations, these methods are incorporated into an adaptive-mesh, finite-element fracture simulation code. A total of 43 fracture tests using symmetrically and asymmetrically loaded double cantilever beam specimens were run to develop crack turning parameters and compare predicted and observed crack paths.
Author
Crack Tips; Crack Geometry; Aircraft Structures; Computational Grids; Computerized Simulation; Damage; Displacement; Fracture Strength; Stress Analysis

20000098579 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne Australia
Microgrid Plastic Strain Analysis of a Representative F-111C Fuel Flow Vent Hole 13 Coupon
Kowal, E.; Heller, M.; Mar. 2000; 52p; In English
Report No.(s): AD-A380006; DSTO-TR-0951; DODA-AR-011-236; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report presents results for the application and associated improvement of an Airframes and Engines Division (AED) microgridding procedure for the determination of highly localized strains. The procedure has been applied to determine plastic strains at the critical location for a plate with a reworked FFVH13 geometry, subjected to F-111C Cold Proof Load Test (CPLT) loading. by using multiple measurements over an increased gauge length of 150 micrometers, highly accurate strains, ranging in accuracy between 57 and 135 micro strain were determined. This accuracy level is approximately an order of magnitude better than the prior microgridding approach. For the critical region, detailed non-linear strain hysteresis responses were obtained, and the measured peak and residual strains of -2.16024% strain and -0.79349% strain respectively agreed well with prior finite element predictions. The measured residual compressive strains at the critical location indicate that there is a significant residual tensile stress, which is consistent with the known occurrence of fatigue cracking in the fleet. This investigation has also provided valuable strain data for use in validating advanced FE based constitutive models, which are currently used and under development in AED for obtaining airframe structural integrity assessments.
DTIC
Fuel Flow; Strain Measurement; Airframes; Load Tests; Vents; F-111 Aircraft; Structural Reliability; Computational Grids

20000099673 Naval Postgraduate School, Monterey, CA USA
Comparison of Expert Judgement Methods Used for Modernization Decision: The Case of MIG-29
Zahainov, Vassyl M.; Jun. 2000; 121p; In English
Report No.(s): AD-A380847; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This research analyzes two approaches to the economic evaluation of an aircraft modernization program. The Analytic Science Corporation (TASC) method is compared with the Logical Decision for Window (LDW) methodology.

TASCFORM-AIR model is a method to quantitatively measure military force modernization. Logical Decisions for Windows software and methodology is based on Multiattribute Utility Theory. It also helps to evaluate decisions quantitatively. The research includes analysis of the reasons, constraints and tendencies in the modern aircraft modernization process. Weapon modernization is usually driven by several objectives, all of them in one way or an another are pertinent to resource allocation. Reliable analytical tools are important to make good decision. Cost- effectiveness and cost utility approaches are evaluated. Comparison of both methodologies is based on the MiG-29 modernization situational model. TASCFORM-AIR Model provides static indicators of military force potential. This can be viewed as measures of effectiveness. The LDW program computes the alternatives' utility by combining its measure levels based on the analyst's preferences. The results produced in both cases are useful in several ways.
DTIC
Decision Making; Cost Effectiveness; Comparison; Aerospace Vehicles

20000101074 Air Force Inst. of Tech., Dept. of Operational Sciences, Wright-Patterson AFB, OH USA
Dynamic Routing of Unmanned Aerial Vehicles Using Reactive Tabu Search
ORourke, Kevin P.; Bailey, T. G.; Hill, Raymond; Carlton, William B.; Nov. 26, 1999; 41p; In English
Report No.(s): AD-A380543; AFIT/GOA/ENS/99M-06; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper we consider the dynamic routing of unmanned aerial vehicles (UAVs) currently in operational use with the US Air Force. Dynamic vehicle routing problems (VRP) have always been challenging, and the airborne version of the VRP adds dimensions and difficulties not present in typical ground-based applications. Previous UAV routing work has focused on primarily on static, pre-planned situations; however, scheduling military operations, which are often ad-hoc, drives the need for a dynamic route solver that can respond to rapidly evolving problem constraints. With these considerations in mind, we examine the use of a Java-encoded metaheuristic to solve these dynamic routing problems, explore its operation with several general problem classes, and look at the advantages it provides in sample UAV routing problems. The end routine provides routing information for a UAV virtual battlespace simulation and allows dynamic routing of operational missions.
DTIC
Pilotless Aircraft; Military Operations; Routes

20000101086 NASA Johnson Space Center, Houston, TX USA
X-38 NASA/DLR/ESA-Dassault Aviation Integrated Aerodynamic and Aerothermodynamic Activities
Labbe, Steve G., NASA Johnson Space Center, USA; Perez, Leo F., NASA Johnson Space Center, USA; Fitzgerald, Steve, NASA Johnson Space Center, USA; Longo, Jose, Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Rapuc, Marc, Dassault Aviation, France; Molina, Rafael, European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; [1999]; 1p; In English; Atmospheric Reentry Vehicles and Systems, 16-18 Mar. 1999, Arachon,, France; Sponsored by Association Aeronautique et Astronautique de France, France
Contract(s)/Grant(s): Proj. 90642FD01; No Copyright; Avail: Issuing Activity; Abstract Only

The characterization of the aeroshape selected for the X-38 [Crew Return Vehicle (CRV) demonstrator] is presently being performed as a cooperative endeavour between NASA, DLR (through its TETRA Program), and European Space Agency (ESA) with Dassault Aviation integrating the aerodynamic and aerothermodynamic activities. The methodologies selected for characterizing the aerodynamic and aerothermodynamic environment of the X-38 are presented. Also, the implications for related disciplines such as Guidance Navigation and Control (GN&C) with its corresponding Flight Control System (FCS), Structural, and Thermal Protection System (TPS) design are discussed. An attempt is made at defining the additional activities required to support the design of a derived operational CRV.
Author
Aerothermodynamics; Flight Control; Proving; Thermal Protection; X-38 Crew Return Vehicle

20000101666 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
Simulation in Support of Flight Testing ***La Simulation pour le Soutien des Essais en Vol***
Hines, Dennis O., Research and Technology Organization, France; September 2000; 57p; In English; The CD-ROM contains full text document in PDF format
Report No.(s): RTO-AG-300-Vol-19; AC/323(SCI)TP/27-Vol-19; ISBN-92-837-1043-6; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche; C01, CD-ROM

For over 40 years simulation has played a key role in flight testing. The purpose of this AGARDograph is to provide an introduction to simulation and how it can be used to support flight testing of fixed-wing aircraft. The document starts by considering the role of simulation, including a brief history and the costs and benefits associated with it. It then discusses the following types of simulations: analytic (non real-time), engineering or man-in-the-loop (real-time), hardware-in-the-loop, Iron

Bird, and in-flight. Simulation development considerations described include: requirements definition; modelling of flight control systems, aerodynamics and the environment; cockpit fidelity, displays and force-feel systems; visual scenes, data display and analysis, including simulation and flight test integration; and verification and validation. The final sections consider how to conduct a simulation-based test programme and the future direction of simulation.
Author
Flight Simulation; Flight Tests; Flight Simulators; Aerodynamics; Fixed Wings; Aircraft Configurations

20000103874 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA
Genetic Algorithm Approaches for Actuator Placement *Final Report*
Crossley, William A., Purdue Univ., USA; [2000]; 13p; In English
Contract(s)/Grant(s): NAG1-2119; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This research investigated genetic algorithm approaches for smart actuator placement to provide aircraft maneuverability without requiring hinged flaps or other control surfaces. The effort supported goals of the Multidisciplinary Design Optimization focus efforts in NASA's Aircraft au program. This work helped to properly identify various aspects of the genetic algorithm operators and parameters that allow for placement of discrete control actuators/effectors. An improved problem definition, including better definition of the objective function and constraints, resulted from this research effort. The work conducted for this research used a geometrically simple wing model; however, an increasing number of potential actuator placement locations were incorporated to illustrate the ability of the GA to determine promising actuator placement arrangements. This effort's major result is a useful genetic algorithm-based approach to assist in the discrete actuator/effector placement problem.
Author
Aircraft Maneuvers; Actuators; Genetic Algorithms; Multidisciplinary Design Optimization

20000104733 Aeromet, Inc., Tulsa, OK USA
High Altitude Observatory (HALO) Uprade
Moskal, Rob; Booker, Garry; Williamson, Mark; Lash, Mike; Kiessling, Jim; Jan. 2000; 34p; In English
Contract(s)/Grant(s): DASG60-99-C-0067
Report No.(s): AD-A380997; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Ballistic Missile Defense Organization (BMDO) has requirements for the collection of missile test and Evaluation data including photo documentation, characterization of target scenes, metric and radiometric characterization of systems, and phenomenology/signature data. This paper will describe the upgrade platform being designed and developed for the High Altitude Observatory (HALO) to address these requirements. The paper will also address the data-flow and computation effort designed to support rapid data products and prototype future sensor platforms that could be applied to surveillance applications. The HALO aircraft has a legacy as a reliable BMDO data collection asset. This data collection has been limited to sensors mounted inside the HALO aircraft cabin while viewing missile scenes through optical windows. The traditional approach has limited data collection capabilities due to window transmission, window aperture, and field of regard (FOR). The HALO upgrade will alleviate these problems with the installation of a pod mounted on the top of the HALO aircraft.
DTIC
Data Acquisition; Observatories; High Altitude; Ballistic Missiles; Missile Tests; Missile Defense

20000104833 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Extracting Mission Semantics from Unmanned Aerial Vehicle Telemetry and Flight Plans
Berridge, Walter T.; Mar. 2000; 113p; In English
Report No.(s): AD-A381090; AFIT/GCS/ENG/00M-01; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

With the acceptance of Unmanned Aerial Vehicles (UAVs) as a primary platform within the Department of Defense (DOD) for gathering intelligence data, the amount of video information being recorded, analyzed, and archived continues to grow. Mechanisms for quickly locating and retrieving video segments of interest amongst the many hours of recorded video are required to accommodate the rapid turnaround expected in today's wartime planning environments. This research demonstrates that text-based data accompanying UAV video yields sufficient information to identify and create data items that can be indexed to provide for rapid identification and retrieval of video segments of interest. Four attributes are derived or calculated from mission-related telemetry and target data: look-direction, look-distance, zoom, and solar illumination direction. These attributes provide indicators of potential scene content and image quality thus allowing analysts to select the best (clearest, most detailed) images of a target or target area. A relational database and two tools, a query and profile tool, are implemented to store the data and provide for the retrieval and presentation of video segments to the user. An analysis of the results shows the methodology to

be favorable for locating and retrieving video segments of interest. Several recommendations to enhance the methodology are provided at the conclusion of the paper.
DTIC
Pilotless Aircraft; Information Retrieval; Relational Data Bases; Telemetry; Intelligence

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

20000094541 Naval Postgraduate School, Monterey, CA USA
Design, Characterization, and Performance of a Valveless Pulse Detonation Engine
Johnson, Robert G.; Jun. 2000; 120p; In English
Report No.(s): AD-A380297; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Current interest in developing a low cost, less complex tactical missile propulsion system that operates on readily available liquid fuels and can operate from low subsonic to a flight Mach number of 5 is driving research on pulse detonation engines. This research program involved the design, construction, and testing of a valveless Pulse Detonation Engine using a JP-10/air mixture as the primary combustible reactants. A small JP-10/oxygen pre-detonation tube was used to initiate the detonation in the JP-10/air mixture in the engine. The engine was tested at various inlet conditions and equivalence ratios in order to determine the detonable regime of the fuel/air mixture. The original area transition from the pre-detonation tube to the main combustion tube appeared to be too extreme, so a tube was added to extend the pre-detonation tube into the throat of a shock focusing device inserted flush with the head end of the main combustion tube to promote more favorable transition conditions.
DTIC
Detonation; Combustion; Spacecraft Propulsion; Liquid Fuels; Hypersonic Speed; Engine Design

20000095934 NASA Marshall Space Flight Center, Huntsville, AL USA
Thermodynamic Cycle Analysis of Magnetohydrodynamic-Bypass Hypersonic Airbreathing Engines
Litchford, R. J., NASA Marshall Space Flight Center, USA; Cole, J. W., NASA Marshall Space Flight Center, USA; Bityurin, V. A., Academy of Sciences (USSR), USSR; Lineberry, J. T., LyTec, LLC, USA; July 2000; 38p; In English
Report No.(s): NASA/TP-2000-210387; M-986; NAS 1.60:210387; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The prospects for realizing a magnetohydrodynamic (MHD) bypass hypersonic airbreathing engine are examined from the standpoint of fundamental thermodynamic feasibility. The MHD-bypass engine, first proposed as part of the Russian AJAX vehicle concept, is based on the idea of redistributing energy between various stages of the propulsion system flow train. The system uses an MHD generator to extract a portion of the aerodynamic heating energy from the inlet and an MHD accelerator to reintroduce this power as kinetic energy in the exhaust stream. In this way, the combustor entrance Mach number can be limited to a specified value even as the flight Mach number increases. Thus, the fuel and air can be efficiently mixed and burned within a practical combustor length, and the flight Mach number operating envelope can be extended. In this paper, we quantitatively assess the performance potential and scientific feasibility of MHD-bypass engines using a simplified thermodynamic analysis. This cycle analysis, based on a thermally and calorically perfect gas, incorporates a coupled MHD generator-accelerator system and accounts for aerodynamic losses and thermodynamic process efficiencies in the various engin components. It is found that the flight Mach number range can be significantly extended; however, overall performance is hampered by non-isentropic losses in the MHD devices.
Author
Thermodynamic Cycles; Thermodynamics; Thermodynamic Efficiency; Magnetohydrodynamics; Magnetohydrodynamic Generators; Turbofan Engines; Hypersonics; Supersonic Combustion Ramjet Engines

20000096257 Naval Postgraduate School, Monterey, CA USA
Development of Shrouded Turbojet to Form a Turboramjet for Future Missile Applications
al–Namani, Suleiman M.; Jun. 2000; 101p; In English
Report No.(s): AD-A378536; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Development of shroud to form part of an afterburner for a turbo-ramjet engine which has a possible application for high speed long range missile applications. Research has been conducted on scram-jet engines with little or no emphasis on a turbojet/ramjet

combined cycle engines. With the possibility of the turbojet providing the thrust at subsonic conditions and the ramjet providing the thrust at supersonic conditions. A small turbojet engine, the Sophia J450 was evaluated experimentally and the results were compared to the prediction using an industry standard program with a perfect comparison over a wide operating range. In order to study possible turbo-ramjet configurations, a Sophia J450 turbojet engine was used with varying shroud configurations, to compare static thrust and specific fuel consumption measured in a test rig. Shroud pressures were also recorded to determine the entrainment rate of the ducts. The short shroud results were found to produce the best performance of the three configurations tested, which were more significant at lower engine spool speed that produced a sharp increase in secondary entrainment pressure. A conical supersonic intake was designed for combined cycle engine at a Mach 2 flight condition resulting in a near optimum cone angle of 15 (deg) to be tested in the new free jet facility. The flight envelope of the baseline engine was also determined over a wide range of flight speeds and operating altitudes.
DTIC
Turbojet Engines; Turboramjet Engines; Engine Design; Shrouds; Supersonic Speed; Afterburning; Missile Design

20000101067 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
An Experimental Investigation on Periodic Forced Vibrations of a Bladed Disk
Duffield, Colin J.; Mar. 2000; 153p; In English
Report No.(s): AD-A380221; AFIT/GAE/ENY/00M-05; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Aircraft engine blades are subject to harmonic forcing produced from periodic wakes created by fixed stators. Prolong or repeated exposure at blade resonant frequencies can cause vibration-induced fatigue, otherwise known as High Cycle Fatigue (HCF). Structural mistuning coupled with HCF causes premature blade failures, excessive operational costs and increased engine servicing. This study offered a novel approach to characterize mistuning effects on bladed disk forced vibration behavior. A model fan reduced in dynamic scale from an operational jet engine fan and with weak inter-blade coupling was fabricated. Aerodynamic disturbances produced by the stators were replicated by magnets attached to a rotating flywheel interacting with similar magnets epoxied to the model fan blades. Magnet configurations mimicked engine order. Accelerometers transducers at blade tips measured forced vibration loads. Transducer response signals were analyzed by a data acquisition system. The flywheel excitation system performed very well in its ability to impart periodic forcing onto the bladed disk. The harmonic forcing input was characterized and capable of producing a wide assortment of forced vibration results. Mistuning and engine order primarily effected system response, specifically in the areas of localization levels, individual blade response profiles, number of maximum blade amplitude peaks and localization frequency range.
DTIC
Aircraft Engines; Blade Tips; Compressor Blades; Forced Vibration; Resonant Frequencies; Mistuning (Turbomachinery); Fatigue (Materials); Data Acquisition; Tuning

20000101663 NASA Ames Research Center, Moffett Field, CA USA
Effects of Hot Streak Shape on Rotor Heating in a High-Subsonic Single-Stage Turbine
Dorney, Daniel J., Virginia Commonwealth Univ., USA; Gundy–Burlet, Karen L., NASA Ames Research Center, USA; [1999]; 18p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experimental data have shown that combustor temperature non-uniformities can lead to the excessive heating of first-stage rotor blades in turbines. This heating of the rotor blades can lead to thermal fatigue and degrade turbine performance. The results of recent studies have shown that variations in the circumferential location (clocking) of the hot streak relative to the first-stage vane airfoils can be used to minimize the adverse effects of the hot streak. The effects of the hot streak/airfoil count ratio on the heating patterns of turbine airfoils have also been evaluated. In the present investigation, three-dimensional unsteady Navier-Stokes simulations have been performed for a single-stage high-pressure turbine operating in high subsonic flow. In addition to a simulation of the baseline turbine, simulations have been performed for circular and elliptical hot streaks of varying sizes in an effort to represent different combustor designs. The predicted results for the baseline simulation show good agreement with the available experimental data. The results of the hot streak simulations indicate: that a) elliptical hot streaks mix more rapidly than circular hot streaks, b) for small hot streak surface area the average rotor temperature is not a strong function of hot streak temperature ratio or shape, and c) hot streaks with larger surface area interact with the secondary flows at the rotor hub endwall, generating an additional high temperature region.
Author
Heating; Rotors; Hubs; Turbines

20000103209 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Results of Super/Hypersonic Transport Propulsion System Research and Development for fiscal 1997. Super/hypersonic transport propulsion system research and development
Mar. 31, 1998; 92p; In Japanese; In English
Report No.(s): DE99-736800; ETDE/JP-99736800; No Copyright; Avail: Department of Energy Information Bridge

In the research and development of control and measurement systems, a dynamic engine model is constructed that reflects the results of recent engine operation, a rule of multivariable control of the 'low-spillage resistance mode' is designed, and the validity of the rule is ascertained through a closed-loop simulation using the dynamic engine model. In the research and development of software in the field of fluid dynamics, analyses of flow details and of distortion inside the intake duct are performed for the evaluation of high-temperature turbine designs, investigation is conducted as to whether the CFD (computational fluid dynamics) technique can be applied to the flow inside RVABI (rear-variable area bypass injector), and inviscid 3D cascade interference is analyzed. In the research and development of combined cycle engines, a model for turbine engines is modified to be usable for combined cycle engines and restart simulation is conducted, when the effect of MSV (mode selector valve) on the combined cycle engine restart characteristics is learned.
NTIS
Propulsion System Performance; Dynamic Models

08
AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots.

20000099725 NASA Langley Research Center, Hampton, VA USA
Multidisciplinary Techniques and Novel Aircraft Control Systems
Padula, Sharon L., NASA Langley Research Center, USA; Rogers, James L., NASA Langley Research Center, USA; Raney, David L., NASA Langley Research Center, USA; [2000]; 14p; In English; 8th; Multidisciplinary Analysis and Optimization, 6-8 Sep. 2000, Long Beach, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-4848; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Aircraft Morphing Program at NASA Langley Research Center explores opportunities to improve airframe designs with smart technologies. Two elements of this basic research program are multidisciplinary design optimization (MDO) and advanced flow control. This paper describes examples where MDO techniques such as sensitivity analysis, automatic differentiation, and genetic algorithms contribute to the design of novel control systems. In the test case, the design and use of distributed shapechange devices to provide low-rate maneuvering capability for a tailless aircraft is considered. The ability of MDO to add value to control system development is illustrated using results from several years of research funded by the Aircraft Morphing Program.
Author
Control Systems Design; Multidisciplinary Design Optimization; Aircraft Control; Aircraft Configurations; Computational Fluid Dynamics; Airframes

20000103558 George Washington Univ., Hampton, VA USA
Estimation of Handling Qualities Parameters of the TU-144 Supersonic Transport Aircraft from Flight Test Data
Curry, Timothy J., Joint Inst. for Advancement of Flight Sciences, USA; August 2000; 120p; In English
Contract(s)/Grant(s): NCC1-29; RTOP 537-08-23-21
Report No.(s): NASA/CR-2000-210290; NAS 1.26:210290; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Low order equivalent system (LOES) models for the TU-144 supersonic transport aircraft were identified from flight test data. The mathematical models were given in terms of transfer functions with a time delay by the military standard MIL-STD-1797A, "Flying Qualities of Piloted Aircraft," and the handling qualities were predicted from the estimated transfer function coefficients. The coefficients and the time delay in the transfer functions were estimated using a nonlinear equation error formulation in the frequency domain. Flight test data from pitch, roll, and yaw frequency sweeps at various flight conditions were used for parameter estimation. Flight test results are presented in terms of the estimated parameter values, their standard errors, and output fits in the time domain. Data from doublet maneuvers at the same flight conditions were used to assess the predictive capabilities of the identified models. The identified transfer function models fit the measured data well and demonstrated good

prediction capabilities. The TU-144 was predicted to be between level 2 and 3 for all longitudinal maneuvers and level I for all lateral maneuvers. High estimates of the equivalent time delay in the transfer function model caused the poor longitudinal rating. Author

TU-144 Aircraft; Flight Tests; Controllability; Transfer Functions

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems.

20000101075 Federal Aviation Administration, John A. Volpe National Transportation Systems Center, Cambridge, MA USA

Calibration Validation for the New Generation Runway Visual Range System *Interim Report, Jan. 1994 - Dec. 1999*

Burnham, David C.; Pawlak, Robert J.; Jul. 2000; 94p; In English; Prepared in collaboration with Scientific and Engineering Solutions, Inc., Orleans, MA.

Contract(s)/Grant(s): A095/A0F090

Report No.(s): AD-A380582; DOT-VNTSC-FAA-00-07; DOT/FAA/AND-740-00/1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A forward scattermeter, consisting of transmitter and receiver heads mounted on a fork, is used in the New Generation Runway Visual Range (NGRVR) System to assess the clarity of the atmosphere. The scatter meter is calibrated by comparison with reference transmissometers. The consistency of the calibration from one unit to the next is verified by measuring the fork geometry and using a performance model to predict the expected calibration variation for different forks. The model also assesses the possible effects of head variations. The variations in fork geometry through the 650-unit production run are presented. The additional steps needed to complete the calibration validation are defined.

DTIC

Runways; Calibrating; Performance Prediction; Scatterometers

20000101661 NASA Ames Research Center, Moffett Field, CA USA

Current Background Noise Sources and Levels in the NASA Ames 40- by 80-Foot Wind Tunnel: A Status Report

Allen, Christopher S., NASA Ames Research Center, USA; Jaeger, Stephen, NASA Ames Research Center, USA; Soderman, Paul, NASA Ames Research Center, USA; Sep. 16, 1999; 3p; In English

Contract(s)/Grant(s): NAS2-14239; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Background noise measurements were made of the acoustic environment in the National Full-Scale Aerodynamics Complex 40- by 80-Foot Wind Tunnel (40x80) at NASA Ames Research Center. The measurements were acquired subsequent to the 40x80 Aeroacoustic Modernization Project, which was undertaken to improve the anechoic characteristics of the 40x80's closed test section as well as reduce the levels of background noise in the facility. The resulting 40x80 anechoic environment was described by Soderman et. al., and the current paper describes the resulting 40x80 background noise, discusses the sources of the noise, and draws comparisons to previous 40x80 background noise levels measurements. At low wind speeds or low frequencies, the 40x80 background noise is dominated by the fan drive system. to obtain the lowest fan drive noise for a given tunnel condition, it is possible in the 40x80 to reduce the fans' rotational speed and adjust the fans' blade pitch, as described by Schmidtz et. al. This idea is not new, but has now been operationally implemented with modifications for increased power at low rotational speeds. At low to mid-frequencies and at higher wind speeds, the dominant noise mechanism was thought to be caused by the surface interface of the previous test section floor acoustic lining. In order to reduce this noise mechanism, the new test section floor lining was designed to resist the pumping of flow in and out of the space between the grating slats required to support heavy equipment. In addition, the lining/flow interface over the entire test section was designed to be smoother and quieter than the previous design. At high wind speeds or high frequencies, the dominant source of background noise in the 40x80 is believed to be caused by the response of the in-flow microphone probes (required by the nature of the closed test section) to the fluctuations in the freestream flow. The resulting background noise levels are also different for probes of various diameters and types. The inflow microphone support strut is also a source of background noise but this source's impact may be minimized by careful design of the strut. In the present paper, the mechanisms mentioned above are discussed in detail. Their frequency and velocity ranges of dominance are defined and the differences between past and current facility background noise levels are presented. This paper gives valuable information for those wishing to make acoustic measurements in the 40x80. With this report and an estimate of the noise levels

produced by the noise source of interest, it should be possible to determine the signal-to-noise ratios and measurement locations to successfully perform aeroacoustic testing in the NASA Ames Research Center's 40- by 80-Foot Wind Tunnel.
Author
Background Noise; Noise Generators; Noise Intensity; Noise Measurement; Acoustic Measurement; Acoustic Properties; Aeroacoustics; Aerodynamic Noise; Signal to Noise Ratios

20000102367 Old Dominion Univ., Dept. of Engineering Management, Norfolk, VA USA
Wind Tunnel Management and Resource Optimization: A Systems Modeling Approach
Jacobs, Derya, A., Old Dominion Univ., USA; Aasen, Curtis A., Old Dominion Univ., USA; [2000]; 17p; In English
Contract(s)/Grant(s): NGT1-52201
Report No.(s): ODURF-182261; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Time, money, and, personnel are becoming increasingly scarce resources within government agencies due to a reduction in funding and the desire to demonstrate responsible economic efficiency. The ability of an organization to plan and schedule resources effectively can provide the necessary leverage to improve productivity, provide continuous support to all projects, and insure flexibility in a rapidly changing environment. Without adequate internal controls the organization is forced to rely on external support, waste precious resources, and risk an inefficient response to change. Management systems must be developed and applied that strive to maximize the utility of existing resources in order to achieve the goal of "faster, cheaper, better". An area of concern within NASA Langley Research Center was the scheduling, planning, and resource management of the Wind Tunnel Enterprise operations. Nine wind tunnels make up the Enterprise. Prior to this research, these wind tunnel groups did not employ a rigorous or standardized management planning system. In addition, each wind tunnel unit operated from a position of autonomy, with little coordination of clients, resources, or project control. For operating and planning purposes, each wind tunnel operating unit must balance inputs from a variety of sources. Although each unit is managed by individual Facility Operations groups, other stakeholders influence wind tunnel operations. These groups include, for example, the various researchers and clients who use the facility, the Facility System Engineering Division (FSED) tasked with wind tunnel repair and upgrade, the Langley Research Center (LaRC) Fabrication (FAB) group which fabricates repair parts and provides test model upkeep, the NASA and LARC Strategic Plans, and unscheduled use of the facilities by important clients. Expanding these influences horizontally through nine wind tunnel operations and vertically along the NASA management structure greatly increases the complexity of developing a model that can be used for successfully implementing a standardized management planning tool. The objective of this study was to implement an Integrated Wind Tunnel Planning System to improve the operations within the aeronautics testing and research group, in particular Wind Tunnel Enterprise. The study included following steps: Conducted literature search and expert discussions (NASA and Old Dominion University faculty), Performed environmental scan of NASA Langley wind tunnel operations as foundation for problem definition. Established operation requirements and evaluation methodologies. Examined windtunnel operations to map out the common characteristics, critical components, and system structure. Reviewed and evaluated various project scheduling and management systems for implementation, Evaluated and implemented "Theory of Constraints (TOC)" project scheduling methodology at NASA Langley wind tunnel operations together with NASA staff.
Derived from text
Management Planning; Wind Tunnels; Systems Engineering; Scheduling; Project Management; Resources Management

10
ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms.

20000097393 NASA Langley Research Center, Hampton, VA USA
Thermal Analysis Methods For Earth Entry Vehicle
Amundsen, Ruth M., NASA Langley Research Center, USA; Dec, John A., NASA Langley Research Center, USA; Lindell, Michael C., NASA Langley Research Center, USA; [2000]; 19p; In English; 11th; Thermal and Fluids Analysis, 21-25 Aug. 2000, Cleveland, OH, USA; Oroginal contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Thermal analysis of a vehicle designed to return samples from another planet, such as the Earth Entry vehicle for the Mars Sample Return mission, presents several unique challenges. The Earth Entry Vehicle (EEV) must contain Martian material samples after they have been collected and protect them from the high heating rates of entry into the Earth's atmosphere. This

requirement necessitates inclusion of detailed thermal analysis early in the design of the vehicle. This paper will describe the challenges and solutions for a preliminary thermal analysis of an Earth Entry Vehicle. The aeroheating on the vehicle during entry would be the main driver for the thermal behavior, and is a complex function of time, spatial position on the vehicle, vehicle temperature, and trajectory parameters. Thus, the thermal analysis must be closely tied to the aeroheating analysis in order to make accurate predictions. Also, the thermal analysis must account for the material response of the ablative thermal protection system (TPS). For the exo-atmospheric portion of the mission, the thermal analysis must include the orbital radiation fluxes on the surfaces. The thermal behavior must also be used to predict the structural response of the vehicle (the thermal stress and strains) and whether they remain within the capability of the materials. Thus, the thermal analysis requires ties to the three-dimensional geometry, the aeroheating analysis, the material response analysis, the orbital analysis, and the structural analysis. The goal of this paper is to describe to what degree that has been achieved.
Author
Thermal Analysis; Procedures; Technology Assessment; Aerodynamic Heating; Atmospheric Entry; Mars Sample Return Missions; Structural Analysis; Temperature Effects

20000096237 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Geoscience Laser Altimeter System (GLAS) for the ICESAT Mission
Abshire, James B., NASA Goddard Space Flight Center, USA; Sun, Xia–Li, NASA Goddard Space Flight Center, USA; Ketchum, Eleanor A., NASA Goddard Space Flight Center, USA; Afzal, Robert S., NASA Goddard Space Flight Center, USA; Millar, Pamela S., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English, 24-28 Jul. 2000, Honolulu, HI, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Laser In space Technology Experiment, Shuttle Laser Altimeter and the Mars Observer Laser Altimeter have demonstrated accurate measurements of atmospheric backscatter and Surface heights from space. The recent MOLA measurements of the Mars surface have 40 cm vertical resolution and have reduced the global uncertainty in Mars topography from a few km to about 5 m. The Geoscience Laser Altimeter System (GLAS) is a next generation lidar for Earth orbit being developed as part of NASA's Icesat Mission. The GLAS design combines a 10 cm precision surface lidar with a sensitive dual wavelength cloud and aerosol lidar. GLAS will precisely measure the heights of the Earth's polar ice sheets, establish a grid of accurate height profiles of the Earth's land topography, and profile the vertical backscatter of clouds and aerosols on a global scale. GLAS is being developed to fly on a small dedicated spacecraft in a polar orbit with a 590 630 km altitude at inclination of 94 degrees. GLAS is scheduled to launch in the summer 2001 and to operate continuously for a minimum of 3 years with a goal of 5 years. The primary mission for GLAS is to measure the seasonal and annual changes in the heights of the Greenland and Antarctic ice sheets. GLAS will continuously measure the vertical distance from orbit to the Earth's surface with 1064 nm pulses from a ND:YAG laser at a 40 Hz rate. Each 5 nsec wide laser pulse is used to produce a single range measurement, and the laser spots have 66 m diameter and about 170 m center-center spacings. When over land GLAS will profile the heights of the topography and vegetation. The GLAS receiver uses a 1 m diameter telescope and a Si APD detector. The detector signal is sampled by an all digital receiver which records each surface echo waveform with I nsec resolution and a stored echo record lengths of either 200, 400, or 600 samples. Analysis of the echo waveforms within the instrument permits discrimination between cloud and surface echoes. Ground based echo analysis permits precise ranging, determining the roughness or slopes of the surface as well as the vertical distributions of vegetation illuminated by the laser. Accurate knowledge of the laser beam's pointing angle is needed to prevent height biases when over sloped surfaces. For surfaces with 2 deg. slopes, knowledge of pointing angle of the beam's centroid to about 8 urad is needed to achieve 10 cm height accuracy. GLAS uses a stellar reference system (SRS) to determine the pointing angle of each laser firing relative to inertial space. The SRS uses a high precision star camera oriented toward local zenith and a gyroscope to determine the inertial orientation of the SRS optical bench. The far field pattern of each laser is measured pulse relative to the star camera with a laser reference system (LRS). Optically measuring each laser far field pattern relative to the orientation of the star camera and gyroscope permits the precise pointing angle of each laser pulse to be determined. GLAS will also determine the vertical distributions of clouds and aerosols by measuring the vertical profile of laser energy backscattered by the atmosphere at both 1064 and 532 nm. The 1064 nm measurements use the Si APD detector and profile the height and vertical structure of thicker clouds. The measurements at 532 nm use new highly sensitive photon counting, detectors, and measure the height distributions of very thin Clouds and aerosol layers. With averaging these can be used to determine the height of the planetary boundary layer. The instrument design and expected performance will be discussed.
Author
Altimeters; Annual Variations; Laser Altimeters; Neodymium Lasers; Optical Radar; Spaceborne Lasers; Topography; Ice; Polar Caps

20000103052 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Uji Sistem Dan Validasi, Jakarta, Indonesia
Static Stability Predictions of RXX-300 DU4 Ground-Air Rockets *Prediksi Stabilitas Statik Roket Darat Udara RKX-300 DU4*
Sumartinah, Endang, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Ginting, Salam, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; October - December 1999; ISSN 0126-0480; Volume 1, No. 4, pp. 41-52; In Malay-Indonesian; Copyright; Avail: Issuing Activity

This paper presents supersonic static stability at 2,3 and 4 Mach numbers of the RKX-300 DU4 ground-air rocket prediction. Aerodynamics characteristics are calculated by using analytic approximation method was developed by F. N. Krasnov. Aerodynamics characteristics are used to predict central aerodynamic position. Because of knowing the central gravity position, then static margin magnitude can be calculated. The calculations result shows that because central aerodynamic to move forward then the static margin magnitude decreases with increase Mach number but also central gravity to move forward with burning of propellant, therefore static stability rocket still fulfilled. The analysis result shows that the static stability of RKX-300 DU4 ground-air rocket fulfilled, because the central aerodynamic position always behind the central of gravity position.
Author
Static Stability; Supersonic Speed; Aerodynamic Characteristics; Performance Prediction; Rocket Engines; Surface to Air Missiles

11
CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft.

20000097379 Virginia Polytechnic Inst. and State Univ., Dept. of Engineering Science and Mechanics, Blacksburg, VA USA
RFI and SCRIMP Model Development and Verification *Final Report, 10 Dec. 1998 - 15 May 2000*
Loos, Alfred C., Virginia Polytechnic Inst. and State Univ., USA; Sayre, Jay, Virginia Polytechnic Inst. and State Univ., USA; Aug. 15, 2000; 176p; In English
Contract(s)/Grant(s): NAG1-1881; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Vacuum-Assisted Resin Transfer Molding (VARTM) processes are becoming promising technologies in the manufacturing of primary composite structures in the aircraft industry as well as infrastructure. A great deal of work still needs to be done on efforts to reduce the costly trial-and-error methods of VARTM processing that are currently in practice today. A computer simulation model of the VARTM process would provide a cost-effective tool in the manufacturing of composites utilizing this technique. Therefore, the objective of this research was to modify an existing three-dimensional, Resin Film Infusion (RFI)/Resin Transfer Molding (RTM) model to include VARTM simulation capabilities and to verify this model with the fabrication of aircraft structural composites. An additional objective was to use the VARTM model as a process analysis tool, where this tool would enable the user to configure the best process for manufacturing quality composites. Experimental verification of the model was performed by processing several flat composite panels. The parameters verified included flow front patterns and infiltration times. The flow front patterns were determined to be qualitatively accurate, while the simulated infiltration times over predicted experimental times by 8 to 10%. Capillary and gravitational forces were incorporated into the existing RFI/RTM model in order to simulate VARTM processing physics more accurately. The theoretical capillary pressure showed the capability to reduce the simulated infiltration times by as great as 6%. The gravity, on the other hand, was found to be negligible for all cases. Finally, the VARTM model was used as a process analysis tool. This enabled the user to determine such important process constraints as the location and type of injection ports and the permeability and location of the high-permeable media. A process for a three-stiffener composite panel was proposed. This configuration evolved from the variation of the process constraints in the modeling of several different composite panels. The configuration was proposed by considering such factors as: infiltration time, the number of vacuum ports, and possible areas of void entrapment.
Author
Resin Transfer Molding; Aircraft Structures; Composite Structures; Computerized Simulation; Entrapment; Fabrication; Technology Assessment

20000096180 Northrop Grumman Corp., Military Aircraft Systems Div., El Segundo, CA USA
Nondestructive Testing of Corrosion Under Coatings *Annual Report*
McLaughlin, Joanne; Di Marzio, Don; Chu, Steve; Isaacs, Hugh S.; Adzic, Gordana D.; Mar. 2000; 52p; In English; Prepared in cooperation with Brookhaven National Laboratory, Upton, NY and Perkin Elmer Corporation, Oak Ridge, TN.

Contract(s)/Grant(s): DACA72-99-C-0011; Proj-1137
Report No.(s): AD-A379677; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Surface corrosion on aluminum aircraft skins, nears joints and around fasteners is often an indicator of buried structural corrosion and cracking. Aircraft paints are routinely removed to reveal the presence of corrosion on the surface of metal structures, and the aircraft is subsequently repainted. This process is expensive, time consuming, and results in the generation of air pollution and process waste. A method is needed to detect the early onset of corrosion on metal substrates covered by protective coatings so that aircraft paints do not have to be stripped without cause. by employing nondestructive techniques to inspect the aircraft exterior structure without removing coatings, the amount of stripping and reapplication of coatings that occurs at the military rework facilities can be substantially reduced.
DTIC

Aircraft Structures; Corrosion; Metal Surfaces; Nondestructive Tests; Protective Coatings; Inspection

20000097930 Naval Postgraduate School, Monterey, CA USA
Calibration to Determine Pressure and Temperature Sensitivities of a Pressure-Sensitive Paint
Muller, Judith A.; Jun. 2000; 88p; In English
Report No.(s): AD-A380715; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In order to obtain quantitative surface pressure measurements of a transonic compressor rotor using pressure sensitive paint (PSP), the temperature dependence of the paint must be taken into consideration. In the present study, a calibration chamber was built and instrumented such that pressure and temperature could be controlled independently. Photodiodes were used to measure the intensity of light emitted by the PSP. An acquisition program was developed to record the necessary calibration data to obtain an analytical representation of the luminescent response of the pressure-sensitive paint over a range of pressures and temperatures characteristic of transonic fans.
DTIC

Pressure Measurement; Compressor Rotors; Transonic Compressors; Thermodynamic Properties; Calibrating

20000103557 NASA Ames Research Center, Moffett Field, CA USA
Forced and Moment Measurements with Pressure-Sensitive Paint
Bell, James H., NASA Ames Research Center, USA; [1999]; 9p; In English; World Aviation Congress, 19-21 Oct. 1999, Burlingame, CA, USA; Sponsored by Society of Automotive Engineers, Inc., USA
Contract(s)/Grant(s): RTOP 519-20-22; Copyright; Avail: Issuing Activity

The potential of pressure-sensitive paint (PSP) to provide aerodynamic loads measurements has been a driving force behind the development of this measurement technique. to demonstrate the suitability of PSP for this purpose, it is necessary to show that PSP-derived pressures can be accurately integrated over the model surface. This cannot be done simply by demonstrating the accuracy of PSP as compared to pressure taps. PSP errors due to misregistration or temperature sensitivity may be high near model edges, where they will have a strong effect on moment measurements, but where pressure taps are rarely installed. A more suitable technique is to compare integrated PSP data over the entire model surface with balance and/or CFD results. This paper presents results from three experiments in which integrated PSP data is compared with balance and/or CFD data. This allows the usefulness of PSP for force and moment measurements, and by implication for loads measurements, to be assessed.
Author

Force Distribution; Moment Distribution; Aerodynamic Loads; Pressure Distribution; Sensitivity; Paints

20000101068 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Simulations of Flowing Supercritical N-Decane
Thornburg, Jeffery T.; Mar. 2000; 70p; In English
Report No.(s): AD-A380268; AFIT/GAE/ENY/00M-12; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Air Force is interested in the research of supercritical jet and rocket fuels, as well as the effects of thermally induced fuel degradation. As future flight vehicles travel at ever increasing Mach numbers, greater heat loads will be imposed upon the fuel. The primary purpose of this study is to develop a computational model for predicting fuel decomposition and bulk fuel temperatures in a stimulated heated flow reactor. The System for Thermal Diagnostic Studies (STDS), located in the Air Force Research Laboratory'S Fuels Branch, is used to analyze fuels under supercritical temperatures and pressures. Computational simulations of the STDS reactor are performed to better understand the heat transfer, fluid dynamics, and chemistry associated with fuel flow through the STDS reactor. A simplified global chemistry model is incorporated into the computational simulation. Predictions of the current model are compared to the results of the STDS experiments, which employ flowing n-decane. The proposed computational model is validated using experimental data obtained at different flow rates after thermally stressing the

n-decane fuel. The model predictions agree well with the experimentally measured results. The computational model serves as a tool to study how various physical and experimental parameters affect fuel degradation.
DTIC
Jet Engine Fuels; Supercritical Flow; Flow Velocity; Degradation; Research Vehicles; Temperature Effects; Fuel Flow; Heat Transfer

12
ENGINEERING (GENERAL)

Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention.

20000097959 Creare, Inc., Hanover, NH USA
Life and Reliability Characteristics of TurboBrayton Coolers
Breedlove, Jeff J., Creare, Inc., USA; Zagarola, Mark, Creare, Inc., USA; Nellis, Greg, Creare, Inc., USA; Dolan, Frank, Creare, Inc., USA; Swift, Walt, Creare, Inc., USA; Gibbon, Judith, NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; 11th; 11th International Cryocooler Conference, Jun. 2000, CO, USA
Contract(s)/Grant(s): NAS5-31281; No Copyright; Avail: Issuing Activity; Abstract Only

Wear and internal contaminants are two of the primary factors that influence reliable, long-life operation of turbo-Brayton cryocoolers. This paper describes tests that have been conducted and methods that have been developed for turbo-Brayton components and systems to assure reliable operation. The turbomachines used in these coolers employ self-acting gas bearings to support the miniature high-speed shafts, thus providing vibration-free operation. Because the bearings are self-acting, rubbing contact occurs during initial start-up and shutdown of the machines. Bearings and shafts are designed to endure multiple stop/start cycles without producing particles or surface features that would impair the proper operation of the machines. Test results are presented for a variety of turbomachines used in these systems. The tests document extended operating life and start/stop cycling behavior for machines over a range of time and temperature scales. Contaminants such as moisture and other residual gas impurities can be a source of degraded operation if they freeze out in sufficient quantities to block flow passages or if they mechanically affect the operation of the machines. A post-fabrication bakeout procedure has been successfully used to reduce residual internal contamination to acceptable levels in a closed cycle system. The process was developed during space qualification tests on the NICMOS cryocooler. Moisture levels were sampled over a six-month time interval confirming the effectiveness of the technique. A description of the bakeout procedure is presented.
Author
Brayton Cycle; Service Life; Coolers; Turbomachinery; Component Reliability; Reliability Analysis; Turbine Engines; Fabrication; Miniaturization

20000095641 Naval Postgraduate School, Monterey, CA USA
The Regional Jet, Cancer or Cure? A Trend Analysis Detailing the Effects of the Regional Jet on the Quality of Air Service Offered at Small Community Airports
Simmons, Torrence P.; Jun. 2000; 79p; In English
Report No.(s): AD-A380917; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

There are 201 communities across the continental USA with 50,000 or less enplanements and commercial air service being provided exclusively by turboprop or propeller driven aircraft. The character and quality of air service to these communities has been consistently changing since the Airline Deregulation Act of 1978. The insurgence of the Regional Jet into the regional aviation marketplace has been the recent instigator that has changed the quality determinants of regional air service. This study determines the influence of these factors in the determination of an airport's demand for air service, to predict which of the 201 communities would most likely lose its air service. The resulting findings were that 79 of the 201 small community airports were identified as those who had a possibility of losing air service and 34 of those 7 were identified as airports most likely to lose air service in the next decade.
DTIC
Air Jets; Air Quality; Commercial Aircraft; Transport Aircraft; Turboprop Aircraft; Air Transportation

20000104738 Naval Postgraduate School, Monterey, CA USA
Transonic Compressor Test Rig Rebuild and Initial Results with the Sanger Stage
O'Brien, Joseph M.; Jun. 2000; 107p; In English

Report No.(s): AD-A381019; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The NPS Transonic Compressor Test Rig was rebuilt and initial testing was conducted on the Sanger Stage, which was designed using CFD techniques. Improvements to the existing monitoring equipment, test rig instrumentation, and data acquisition software were all made in preparation for testing. A Plexiglas casewall was chosen to accommodate pressure-sensitive paint measurements. Wall heating was used to control tip-clearance. The initial performance data, to 70% design speed, were compared with predictions using a 3-dimensional viscous code.
DTIC

Transonic Compressors; Computational Fluid Dynamics; Test Stands; Pressure Measurement

20000104854 Naval Postgraduate School, Monterey, CA USA

Inviscid Aerodynamic Predictions of Hypersonic Elliptical Projectiles: A Comparative Study of the Effects of Stabilizing Surfaces

Boyle, Christopher; Jun. 2000; 139p; In English

Report No.(s): AD-A380851; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

With the advent of "smart" munitions, the US and its allies are attempting to design more accurate tactical weapons. of interest are relatively inexpensive barrel-launched projectiles capable of accuracy associated with guided munitions. This research studies potential configurations for a new class of kinetic energy projectiles. From past research, it has been shown that projectiles with elliptical cross-sections are more stable in flight than those with circular cross-sections. This research looks at one particular shape, an elliptical cone, and numerically predicts the aerodynamic attributes in inviscid, steady, hypersonic flow. In particular, the effects of different stabilizing surface configurations are evaluated. A residual benefit of this research is to show that ZEUS, an afterbody solver typically used for missile design, is capable of providing solutions for these configurations. The findings of this research will be delivered to the Chief, Aerodynamics Branch, Army Research Laboratory, and will fulfill part of ARL's commitment in a Key Technical Area agreement with the research laboratories of our allies.
DTIC

Aerodynamics; Hypersonics; Kinetic Energy; Stabilization

20000095490 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Struktur, Mekanika Roket san sistem Antariksa, Jakarta, Indonesia

Determination of RK 150-LPN Rocket Fin Structure Feasibility on the Basis of Structural Buckling ***Penentuan Kelayakan Struktur Sirip Roket RX-150-LPN Berdasarkan Lendutan Struktur***

Bintoro, Atik, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; January 2000; ISSN 0126-0480; Volume 2, No. 1, pp. 27-31; In Malay-Indonesian; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The capability of wing structures of RX-150-LPN rocket made from stainless steel plate with the thickness of 8, 7, 6 and 5 mm has been analyzed. It includes the endurance of axial and tangential forces. Both forces can create deflection and stress to wing structures. It is obtained that the maximum stress is 8.643 x 10 (exp 5) Nm (exp -2) and deflection ratio is 1.939 % in 5 mm.
Author

Buckling; Feasibility; Aircraft Structures; Fins; Rocket Engines

13
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology.

20000096454 NASA Dryden Flight Research Center, Edwards, CA USA

ERAST: Scientific Applications and Technology Commercialization

Hunley, John D., Compiler, NASA Dryden Flight Research Center, USA; Kellogg, Yvonne, Compiler, NASA Dryden Flight Research Center, USA; September 2000; 195p; In English; ERAST: Scientific Applications and Technology Commercialization, 13 Oct. 1999, Edwards, CA, USA

Contract(s)/Grant(s): RTOP 282-00-00-76-GJ-TT

Report No.(s): NASA/CP-2000-209031; NAS 1.55:209031; H-2383; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

This is a conference publication for an event designed to inform potential contractors and appropriate personnel in various scientific disciplines that the ERAST (Environmental Research Aircraft and Sensor Technology) vehicles have reached a certain level of maturity and are available to perform a variety of missions ranging from data gathering to telecommunications. There

are multiple applications of the technology and a great many potential commercial and governmental markets. As high altitude platforms, the ERAST vehicles can gather data at higher resolution than satellites and can do so continuously, whereas satellites pass over a particular area only once each orbit. Formal addresses are given by Rich Christiansen, (Director of Programs, NASA Aerospace Technology Ent.), Larry Roeder, (Senior Policy Advisor, U.S. Dept. of State), and Dr. Marianne McCarthy, (DFRC Education Dept.). The Commercialization Workshop is chaired by Dale Tietz (President, New Vista International) and the Science Workshop is chaired by Steve Wegener, (Deputy Manager of NASA ERAST, NASA Ames Research Center.
Author
Telecommunication; Remote Sensing; Research Aircraft; Commercialization; Technology Utilization; Data Collection Platforms; Conferences

20000097054 Aeronautical Research Inst. of Sweden, Bromma, Sweden
Optimization of wind turbine rotors
Holmkvist, J.; May 31, 1998; 85p; In English
Report No.(s): DE99-738847; FFA-TN-1998-19; No Copyright; Avail: Department of Energy Information Bridge

A computer program for aerodynamic optimization of wind turbine rotors has been written in FORTRAN with the purpose to maximize the annual energy production. The constraints is the maximum power output from the turbine and maximum and minimum values on the design variables. The design of the rotor is described by the chord- and twist distribution. The chord- and twist distributions are described with Bezier splines which, with a few number of control points, are very flexible. The Bezier control points are the design variables which are optimized by the optimization program. The optimization method used in the program is the Method of Moving Asymptotes, MMA, suggested by Krister Svanberg at the Royal Institute of Technology in Stockholm. MMA is a stable method and it seems suitable for this application. It is also in general easy to implement constraints. It seems like there are many local maximum points and the variations in the annual energy production between the total maximum points are very small, so there are many solutions to choose between and finding the global maximum point can be a problem. The problem could possibly be avoided with smaller wind steps near the rated wind. In future versions of the optimization program the Reynolds number dependents of the aerodynamic coefficients should be taken into consideration. Constraints for the thrust and the aerodynamic noise should also be implemented in the program.
NTIS
Wind Turbines; Rotors; Design Analysis

20000097055 Aeronautical Research Inst. of Sweden, Bromma, Sweden
Dynamic stall and three-dimensional effects. EC DGXII Joule project JOU2-CT93-0345 ***Final Report***
Bjoerck, A.; Jan. 31, 1996; 121p; In English
Report No.(s): DE99-738848; FFA-TN-1995-31; No Copyright; Avail: Department of Energy Information Bridge

This report describes the results of the project 'Dynamic stall and three-dimensional effects' which was carried out within the framework of the European Commission JOULE II programme. The objective of the current project has been to increase the understanding of the three-dimensional and unsteady aerodynamics of stall controlled HAWT's. The objectives have also been to develop 'engineering methods' - suitable for inclusion into aero-elastic codes - for dynamic stall and 3-D effects. The agreement between measurements and aeroelastic calculations often becomes unsatisfactory in the stalled region if 2-D steady aerofoil data are used. A major cause for this discrepancy seems to be due to the neglect, or unsatisfactory modeling, of dynamic stall and three-dimensional aerofoil characteristics for the rotating blade. Within the project: * 3-D (rotational) effects and dynamic stall have been studied by analysis of experiments and by the use of calculations. Calculations have been made with Navier-Stokes codes and viscid/inviscid interaction codes, * An unsteady 3-D vortex particle free wake method (GENVUP) has been extended with a scheme to model separation, * Five different 'engineering methods' for predicting dynamic stall are presented, * Two 3-D (rotational effects) 'engineering methods' are presented. The 'engineering methods' for dynamic stall have been applied to simulate the measured dynamic stall for 2-D tests as well as for measurements of C(sub n) on a blade section of a rotating blade. The methods seem to be sufficiently representative in order to calculate the main dynamic loads for a wind turbine during ordinary operation in stall, including mean loads and dependency upon turbulence intensity. However, the prediction of the limiting case, the stall induced vibration problem, has not been studied in the current project.
NTIS
Aerodynamic Stalling; Aeroelasticity; Three Dimensional Flow

14
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions.

20000096506 Civil Aeromedical Inst., Oklahoma City, OK USA
Distribution of Butalbital in Biological Fluids and Tissues *Final Report*
lewis, Russel J., Civil Aeromedical Inst., USA; Southern, Travis L., Civil Aeromedical Inst., USA; Canfield, Dennis V., Civil Aeromedical Inst., USA; August 2000; 8p; In English
Contract(s)/Grant(s): AM-B-00-TOX-202
Report No.(s): DOT/FAA/AM-00/29; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the investigation of fatal aviation accidents, postmortem samples from the pilot/copilot are submitted to the Federal Aviation Administration's (FAA's) Civil Aeromedical Institute for toxicological analysis. Blood specimens are received in approximately 70% of the fatal aviation accidents analyzed by the FAA's Toxicology and Accident Research Laboratory. The lack of blood available is usually due to the severe damage to a pilot's body during an aviation accident and/or to the length of time taken to recover the body following an accident. Therapeutic and toxic levels for most drugs are reported in the scientific literature for blood and plasma only. Therefore, it is imperative for an accident investigator and forensic toxicologist to be able to estimate drug concentrations in a fatal aviation accident victim's blood from the available concentrations in the tissue. This is exemplified by a recent aviation fatality where butalbital was identified in muscle tissue of a pilot, and the investigators wanted to know the approximate butalbital concentration expected in the victim's blood. Butalbital, a short-acting barbiturate found in combination with other drugs such as acetaminophen, aspirin, codeine, and caffeine, is commonly prescribed for the treatment of tension headaches. Certain side effects of butalbital, such as drowsiness, sedation, dizziness, and a feeling of intoxication, could affect pilot performance and become a significant factor in an aviation accident. Thus, our laboratory determined the distribution of butalbital ill various postmortem tissues and fluids. The distribution coefficients established for butalbital, expressed as specimen/blood ratios, were found to be as follows: muscle (0.66 +/- 0.09), kidney (0.98 +/- 0.09), lung (0.87 +/- 0.06), spleen (0.75, +/- 0.03), brain (0.96 +/- 0.07), liver (2.22 +/- 0.04), liver fluid (0.89 +/- 0.23), heart (0.91 +/- 0.17), bile (0.94 +/- 0.22), and urine (0.73, +/- 0.16). The results demonstrate that muscle, kidney, lung, spleen, brain, liver, and heart can be used reliably to estimate butalbital blood concentrations.
Author
Aircraft Accident Investigation; Aircraft Pilots; Blood Plasma; Body Fluids; Brain; Damage; Intoxication; Physiological Effects; Pilot Performance; Sensory Feedback

20000094652 Lockheed Martin Space Operations, Houston, TX USA
Reallusory Viewing: A Study of the Application of Virtual Windows in Hermetic Environments *Final Report*
Staderman, William P., Virginia Polytechnic Inst. and State Univ., USA; Adams, Constance M., Lockheed Martin Space Operations, USA; [1999]; 4p; In English; Environmental Systems, 12-15 Jul. 1999, Denver, CO, USA; Sponsored by Society of Automotive Engineers, Inc., USA
Contract(s)/Grant(s): NAS9-18800
Report No.(s): Rept-1999-01-2138; Copyright; Avail: Issuing Activity

The presence of windows in various building designs (e.g., offices, hospitals, houses, etc.) has been correlated with improved psychological well-being and performance. The application in hermetic environments of "virtual windows", an electronic monitor integrated into the interior environment for viewing external landscapes, is expected to correlate with similar positive effects. In order to properly install virtual windows, the display content and the display characteristics need to be considered.
Author
Virtual Reality; Computerized Simulation; Environment Simulation; Flight Simulation; Motion Simulation; Three Dimensional Models

20000098524 Naval Aerospace Medical Research Lab., Pensacola, FL USA
Selection of Officers for US Naval Aviation Training
Williams, Henry P., Naval Aerospace Medical Research Lab., USA; Albert, Amanda O., Naval Aerospace Medical Research Lab., USA; Blower, David J., Naval Aerospace Medical Research Lab., USA; Officer Selection; August 2000, pp. 18-1 - 18-7; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper reviews the process of selecting officers for U.S. naval aviation training and describes one of the principal selection tools, the Aviation Selection Test Battery (ASTB). The 1992 version of the ASTB is a paper-and-pencil test administered to all

applicants for naval aviation training. ASTB scores and ground school and flight training performance data were available for 2852 student naval aviators and student naval flight officers, and these data were used to re-assess the validity of the ASTB in predicting student performance. The results indicated that the ASTB remains a valid predictor of ground school and flight training grades, and to a lesser extent, attrition from training. For a small subset of the sample used in these analyses, data from a computer-based performance test (CBPT) were also available. The CBPT required subjects to engage in multi-axis tracking tasks concurrently with other cognitive tasks, such as dichotic listening and working memory tasks. Scores from the ASTB, the CBPT, and grades from ground school were entered into a linear regression upon primary flight training grades. The results showed that the combination of ground school and CBPT scores can be used as a good predictor of performance (R(sup 2) = .33, p <.0001).Althoughtheseresuls will require cross validation, the CBPT shows promise as a new selection tool. The importance of these results is discussed in the context of a recently developed computer-based version of the ASTB.
Author
Aircraft Pilots; Flight Training; Pilot Selection; Military Aviation; Performance Prediction; Qualifications

20000098525 National Defence Headquarters, Director Human Resources Research and Evaluation, Ottawa, Ontario Canada
CAPSS: The Canadian Automated Pilot Selection System
Woycheshin, D. E., National Defence Headquarters, Canada; Officer Selection; August 2000, pp. 19-1 - 19-5; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

The Canadian Automated Pilot Selection System (CAPSS) is a computerized simulator of a single engine light aircraft used in the selection of pilots for the Canadian Forces. This paper describes the characteristics of the CAPSS simulator and the types of data it collects. The development of the CAPSS equation that predicts the probability of success in flying training is discussed and the results of the initial validation and cross-validation are presented. Demographic characteristics of applicants assessed by CAPSS since its introduction in February, 1997, are presented. Finally, some of the strengths and weaknesses of CAPSS are discussed.
Author
Computerized Simulation; Pilot Selection; Flight Simulators; Qualifications; Canada; Armed Forces (Foreign); Military Aviation

20000098526 Metrica, Inc., Senior Research Scientists, San Antonio, TX USA
Difficulties in Accessing a Representative Pilot Force: The Demographic Challenge and Views of Minority Pilot Focus Groups
Barucky, Jerry M., Metrica, Inc., USA; Stone, Brice M., Metrica, Inc., USA; Officer Selection; August 2000, pp. 20-1 - 20-9; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

The USA Air Force has expressed concern about under representation of minority officers in its pilot force. Historically, there have been relatively smaller percentages of African-American and Hispanic officers among Air Force pilots than might be expected from other demographic and educational data. As part of a more general study of demographic trends and their effects on the Air Force personnel system, researchers were tasked to gather information pertaining to minority community attitudes about the military and flying careers. The researchers gathered this information from focus group interview sessions among African-American and Hispanic pilots and pilot trainees and from Air Force Academy and Air Force Reserve Officer Training Corps (AFROTC) minority recruiters. The responses highlight reasons for the lack of interest in flying careers among the most competitive minority students. They also offer suggestions for enhancing the selection/recruitment and training processes to attract a greater percentage of the highly qualified minority students and allow them to compete successfully for pilot positions. This paper presents a brief summary of that report (Barucky, 1998).
Author
Armed Forces (USA); Aircraft Pilots; Minorities; Occupation; Pilot Selection; Motivation

20000098539 Saville and Holdsworth Ltd., UK R and D Director, Thames Ditton, UK
Technologies for Integrated Assessment and Selection Systems
Burke, Eugene, Saville and Holdsworth Ltd., UK; Officer Selection; August 2000, pp. 33-1 - 33-5; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper looks forward from the last NATO review of computer-based assessment (CBA) of military personnel (Burke and Van Raay, 1993; see also Burke, 1993, and Burke et al., 1995). At the time of that report, research and development among NATO nations could be summarized according to three areas of work: (1) Desktop systems delivering traditional tests and questionnaires as well as more dynamic tasks developed from paradigms from cognitive psychology, using LANs and WANs, and from which the principle gains were the increased reliability and reduced costs from automation of the assessment process. Systems

characterizing this approach included those developed by the Royal Air Force (RAF) in the UK for officer and aircrew selection (Burke, 1992, and Burke et al., 1994), Project A in the US, Taskomat in the Netherlands and the ESPACE system in France. (2) Simulation-based assessment (SBA) systems for delivery of sophisticated work sample measures usually administered after prior screening using paper-and-pencil or desktop tests and questionnaires, and developed for selection to high risk/high cost roles such as aircraft pilot. Systems characterising this approach included the CAPSS system in Canada and the GUTS in Belgium, as well as a range of systems developed in Germany. The primary focus of these systems was increased validity and reduced training costs against which the substantial costs of SBA development and administration could be recovered. (3) Adaptive testing systems that sought to exploit capabilities unique to CBA in delivering tailored testing (i.e. measurement geared to an individual's level of ability). The US CAT-ASVAB programme stands as the most substantial work in this area to date. As well as adaptive testing, the late 1980s and early 1990s also saw the advent of item generation techniques in which item engines contained in the test software produce the item or task on-the-fly during a test administration. The UK British Army Recruit Battery (BARB) system was the first item generative system to go live in military assessment, though the same methodology was also used to produce fixed parallel forms of paper-and-pencil tests for the Royal Navy (the ABC test battery).
Author
Computer Techniques; Personnel Selection; Computer Programs; Aircraft Pilots; Qualifications; Psychological Tests

20000096492 NASA Johnson Space Center, Houston, TX USA
Critical Path Web Site
Robinson, Judith L., NASA Johnson Space Center, USA; Charles, John B., NASA Johnson Space Center, USA; [2000]; 1p; In English
Contract(s)/Grant(s): NAS9-97166; No Copyright; Avail: Issuing Activity; Abstract Only

Approximately three years ago, the Agency's lead center for the human elements of spaceflight (the Johnson Space Center), along with the National Biomedical Research Institute (NSBRI) (which has the lead role in developing countermeasures) initiated an activity to identify the most critical risks confronting extended human spaceflight. Two salient factors influenced this activity: first, what information is needed to enable a "go/no go" decision to embark on extended human spaceflight missions; and second, what knowledge and capabilities are needed to address known and potential health, safety and performance risks associated with such missions. A unique approach was used to first define and assess those risks, and then to prioritize them. This activity was called the Critical Path Roadmap (CPR) and it represents an opportunity to develop and implement a focused and evolving program of research and technology designed from a "risk reduction" perspective to prevent or minimize the risks to humans exposed to the space environment. The Critical Path Roadmap provides the foundation needed to ensure that human spaceflight, now and in the future, is as safe, productive and healthy as possible (within the constraints imposed on any particular mission) regardless of mission duration or destination. As a tool, the Critical Path Roadmap enables the decision maker to select from among the demonstrated or potential risks those that are to be mitigated, and the completeness of that mitigation. The primary audience for the CPR Web Site is the members of the scientific community who are interested in the research and technology efforts required for ensuring safe and productive human spaceflight. They may already be informed about the various space life sciences research programs or they may be newcomers. Providing the CPR content to potential investigators increases the probability of their delivering effective risk mitigations. Others who will use the CPR Web Site and its content include program managers and administrators who track the program and are involved in decisions regarding resource allocation and program evaluation.
Author
World Wide Web; Manned Space Flight; Flight Safety; Aerospace Environments

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MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science.

20000095493 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Kendali Roket dan Satelit, Jakarta, Indonesia
Decoupled Sliding Mode Control for Non-Linear Systems and Its Applications ***Decoupled Sliding Mode Control Untuk Sistem Non Linier Dan Aplikasinya***
Andiarti, Rika, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; January 2000; ISSN 0126-0480; Volume 2, No. 1, pp. 1-7; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The sliding mode control method for a nonlinear system which can be decoupled by state variable feedback is developed, Based on variable structure system (VSS) theory and Lyapunov method, a discontinuous control law is derived. This design

approach is applied to synthesize a flight control system for asymptotically decoupled control of bank angle, pitch angle and sideslip angle in nonlinear maneuver of aircraft.
Author
Nonlinear Systems; Modes; Decoupling; Flight Control; Aircraft Maneuvers

20000099672 Brown Univ., Div. of Applied Mathematics, Providence, RI USA
High Order Accuracy Computational Methods for Long Time Integration of Nonlinear PDEs in Complex Domains *Final Report, 1 May 1996 - 30 Nov. 1998*
Gottlieb, David; Shu, C. W.; Fischer, P. F.; Don, W. S.; Hesthaven, J.; Nov. 30, 1998; 20p; In English
Contract(s)/Grant(s): F49620-96-1-0150
Report No.(s): AD-A380856; TR-4; AFRL-SR-BL-TR-00-0379; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The overarching goal of this research was to construct stable, robust and efficient high order accurate computational methods for long time integration of nonlinear partial differential equations. High order accuracy methods (Spectral, Finite Difference and Finite Elements) for the numerical simulations of flows with discontinuities, in complex geometries were developed. In particular applications in supersonic combustion were emphasized. Specific research subjects included: Robust high order compact difference schemes, ENO and WENO schemes, discontinuous Galerkin methods, the resolution of the Gibbs phenomenon, parallel computing and high order accurate boundary conditions. In order to overcome the difficulties stemming from complicated geometries, we have developed multidomain techniques as well as spectral methods on arbitrary grids. Several multidimensional codes for supersonic reactive flows had been constructed as well as a library of spectral codes (Pseudopack).
DTIC
Partial Differential Equations; Supersonic Combustion; Supersonic Flow; Finite Element Method; Finite Difference Theory; Spectral Methods; Galerkin Method

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PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics.

20000097572 Hampton Univ., School of Engineering and Technology, VA USA
Mixing, Noise and Thrust Benefits Using Corrugated Designs, *1 Jun. 1997 - 31 May 2000*
Morgan, Morris H., III, Hampton Univ., USA; Gilinsky, Mikhail M., Hampton Univ., USA; August 2000; 6p; In English
Contract(s)/Grant(s): NAG1-1936; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

These projects are directed toward the analysis of several concepts for nozzle and inlet performance improvement and noise reduction from jet exhausts. Currently. The FM&AL also initiates new joint research between the HU/FM&AL, the Hyper-X Program Team at the LaRC, and the Central Institute of Aviation Motors (CIAM), Moscow, Russia in the field of optimization of fuel injection and mixing in air-breathing propulsion systems. The main results of theoretical, numerical simulation and experimental tests obtained in the previous research are in the papers and patents. The goals of the 14U/FM&AL programs are twofold: 1) to improve the working efficiency of the HU/FM&AL team in generating new innovative ideas and in conducting research in the field of fluid dynamics and acoustics, basically for improvement of supersonic and subsonic aircraft engines, and 2) to attract promising minority students to this research and training and, in cooperation with other HU departments, to teach them basic knowledge in Aerodynamics, Gas Dynamics, and Theoretical and Experimental Methods in Aeroacoustics and Computational Fluid Dynamics (CFD). The research at the HU/FM&AL supports reduction schemes associated with the emission of en 'ne pollutants for commercial aircraft and concepts for reduction of 91 observables for military aircraft. These research endeavors relate to the goals of the NASA Strategic Enterprise in Aeronautics concerning the development of environmentally acceptable aircraft. It is in this precise area, where the US aircraft industry, academia, and Government are in great need of trained professionals and which is a high priority goal of the Minority University Research and Education (MLTREP) Program, that the HU/FM&AL can make its most important contribution.
Derived from text
Aeroacoustics; Fluid Dynamics; Aircraft Engines; Propulsion System Performance; Contaminants; Gas Dynamics; Jet Exhaust; Noise Reduction

20000094469 Pennsylvania State Univ., University Park, PA USA
Determination of Aircraft Sonic Boom Noise Penetration into Seas, Bays, and Lakes for Environmental Assessment *Final Report, Apr. 1996-Feb. 1998*
Sparrow, Victor W.; Feb. 1998; 181p; In English
Contract(s)/Grant(s): F41624-96-1-0006; AF Proj. 3037
Report No.(s): AD-A379672; AFRL-HE-WP-TR-2000-0064; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Sonic boom noise from overwater supersonic aircraft operations penetrates into the water. The present work developed an algorithm to simulate this penetrating sonic boom noise for realistically shaped sonic booms, predictions previously unavailable. The new algorithm assumes that the water surface is fairly flat and that the water is deep enough so that bottom reflections can be ignored. The algorithm was used to model the underwater sonic boom noise for the cases of incident sonic boom waves distorted by atmospheric effects and by common aircraft maneuvers. It was found that certain aircraft maneuvers and atmospheric effects can increase the penetration of the sonic boom noise, while others decrease it.
DTIC
Sonic Booms; Supersonic Aircraft; Noise Pollution; Environment Effects; Sound Waves; Underwater Acoustics

20000095646 Naval Facilities Engineering Service Center, Port Hueneme, CA USA
Jet Engine Test Cell Noise Reduction *Final Report, Oct. 1996-Dec. 1999*
Kodres, C. A.; Aug. 2000; 77p; In English
Report No.(s): AD-A380948; NFESC-TR-2118-ENV; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Passive methods for decreasing jet engine test cell noise emissions are evaluated and compared. Such methods have the dual advantages of low cost and simplicity. In addition, the effect on the aerothermal performance of the test cell is minimal. Sound pressure levels were measured in and around test facilities equipped with various devices to further reduce noise. The data were supplemented with parametric studies of noise reduction techniques conducted using a 1/20th scale physical model of the Navy's standard T-10 jet engine test cell. Methods that attack the noise problem from outside and methods that attack the problem from inside the test cell are assessed, including trees and other vegetation, acoustic walls, core busters, and modifications to the exhaust stack. Mounting screens in the path of the jet and increasing the height of the exhaust stack are found to be the most effective.
DTIC
Jet Engines; Engine Tests; Engine Noise; Jet Aircraft Noise; Noise Pollution; Noise Reduction; Acoustic Attenuation

20000096258 Wyle Labs., Inc., El Segundo, CA USA
An Improved Takeoff Roll Noise Model for NOISEMAP 6.2 *Interim Report, Sep. 1991-Sep. 1992*
Moulton, Carey L.; Brown, David; Sep. 1992; 37p; In English
Contract(s)/Grant(s): F33615-89-C-0531; AF Proj. 7231
Report No.(s): AD-A378578; WR-92-9; AFRL-HE-WP-TR-2000-0019; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The modeling of noise of stationary aircraft prior to and during its takeoff roll is one of the many elements included in NOISEMAP. This report describes the current Takeoff Roll Model contained in NOISEMAP. Features of this model include static ground runup, its associated directivity pattern, and adjustments because of the acceleration of the aircraft during takeoff roll.
DTIC
Aircraft Noise; Computer Programs; Noise Pollution; Models; Takeoff

20000097939 Woods Hole Oceanographic Inst., MA USA
Field Measurements of Sonic Boom Penetration Into the Ocean
Sohn, R. A., Woods Hole Oceanographic Inst., USA; Vernon, F., Scripps Institution of Oceanography, USA; Hildebrand, J. A., Scripps Institution of Oceanography, USA; Webb, S. C., Scripps Institution of Oceanography, USA; Journal of the Acoustical Society of America; June 2000; ISSN 0001-4966; Volume 107, No. 6, pp. 3073-3083; In English; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Six sonic booms, generated by F-4 aircraft under steady fight at a range of altitudes (610-6100 m) and Mach numbers (1.07-1.26), were measured just above the air/sea interface, and at five depths in the water column. The measurements were made with a vertical hydrophone array suspended from a small spar buoy at the sea surface, and telemetered to a nearby research vessel. The sonic boom pressure amplitude decays exponentially with depth, and the signal fades into the ambient noise field by 30-50 in, depending on the strength of the boom at the sea surface. Low-frequency components of the boom waveform penetrate significantly deeper than high frequencies. Frequencies greater than 20 Hz are difficult to observe at depths greater than about 10 m. Underwater sonic boom pressure measurements exhibit excellent agreement with predictions from analytical theory, despite

the assumption of a flat air/sea interface. Significant scattering of the sonic boom signal by the rough ocean surface is not detected. Real ocean conditions appear to exert a negligible effect on the penetration of sonic booms into the ocean unless steady vehicle speeds exceed Mach 3, when the boom incidence angle is sufficient to cause scattering on realistic open ocean surfaces.
Author
Sonic Booms; Pressure Measurement; Supersonic Flight; Aerodynamic Noise; Jet Aircraft Noise; F-4 Aircraft

20000098578 Florida Agricultural and Mechanical Univ., Dept. of Chemical Engineering, Tallahassee, FL USA
Construction of a Pulsed Streamer Corona Reactor *Final Report, Jun. 1994 - Jun. 1995*
Locke, Bruce R.; Finney, Wright C.; Jun. 05, 1995; 151p; In English
Contract(s)/Grant(s): F08637-94-M-6015; AF Proj. 1900
Report No.(s): AD-A380008; AFRL-ML-WP-TR-2000-4534; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The objective of this effort was to construct a pulsed corona discharge capability for conducting investigations into the destruction of noxious combustion products from jet engines and ground support equipment. As the first step in the investigations, a pulsed corona discharge system consisting of a high-voltage AC power supply, a rotating spark gap and pulse-forming electronic components, and stainless steel pulsed corona reactor was built and commissioned. This report documents the design, construction, and operation of the reactor. Results of specific investigations into the effects of the pulsed corona reactor on various waste streams will be documented in separate reports.
DTIC
Jet Engines; Jet Exhaust; Electric Corona; Combustion Products; Contaminants; Reactor Design; Air Pollution

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SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula.

20000097048 Old Dominion Univ., Research Foundation, Norfolk, VA USA
Geographical Database Integrity Validation *Final Report*
Jacobs, Derya, Old Dominion Univ., USA; Kauffman, Paul, Old Dominion Univ., USA; Blackstock, Dexter, Old Dominion Univ., USA; Aug. 24, 2000; 48p; In English
Contract(s)/Grant(s): NAG1-2199
Report No.(s): ODUR$F-193711; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Airport Safety Modeling Data (ASMD) was developed at the request of a 1997 White House Conference on Aviation Safety and Security. Politicians, military personnel, commercial aircraft manufacturers and the airline industry attended the conference. The objective of the conference was to study the airline industry and make recommendations to improve safety and security. One of the topics discussed at the conference was the loss of situational awareness by aircraft pilots. Loss of situational awareness occurs when a pilot loses his geographic position during flight and can result in crashes into terrain and obstacles. It was recognized at the conference that aviation safety could be improved by reducing the loss of situational awareness. The conference advised that a system be placed in the airplane cockpit that would provide pilots with a visual representation of the terrain around airports. The system would prevent airline crashes during times of inclement weather and loss of situational awareness. The system must be based on accurate data that represents terrain around airports. The Department of Defense and the National Imagery and Mapping Agency (NIMA) released ASMD to be used for the development of a visual system for aircraft pilots. ASMD was constructed from NIMA digital terrain elevation data (DTED).
Derived from text
Aircraft Safety; Data Bases; Geography; Airports; Computer Programs

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